PECTORALIS MAJOR MYOCUTANEOUS FLAP IN ORAL & MAXILLOFACIAL RECONSTRUCTION

Dissertation submitted to

THE TAMILNADU Dr.M.G.R. MEDICAL UNIVERSITY

In partial fulfillment for the Degree of

MASTER OF DENTAL SURGERY

BRANCH III

ORAL AND MAXILLOFACIAL SURGERY

MARCH 2013

CERTIFICATE

This is to certify that the dissertation titled **"PECTORALIS MAJOR MYOCUTANEOUS FLAP IN ORAL & MAXILLOFACIAL RECONSTRUCTION"** is a bonafide record of work done by **Dr. Shanmugharaj.T** under my guidance during his post graduate study period from 2010-2013.

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It has not been submitted (partially or fully) for the award of any other degree or diploma

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Date : 26-12-12

Place : Coimbatore.

ACKNOWLEDGEMENT

This thesis would not have been possible without the efforts of a large number of people to whom I am greatly indebted.

No words can express what I feel when I sit down to express my gratitude to my teacher ***Dr.A.T.Vigneshwaran, M.D.S.,*** *Professor and Head of the Department, Department of Oral & Maxillofacial Surgery, Sri Ramakrishna Dental College and Hospital, Coimbatore. It has been a privilege to have associated with him as a student during my post graduation.*

I avail this opportunity to express my deep sense of gratitude and thanks to my teacher and guide ***Dr. L.Deepanandan, M.D.S.,*** *Professor Department of Oral and Maxillofacial Surgery, Sri Ramakrishna Dental College and Hospital, Coimbatore. His constant help, encouragement and initiative guidance has made this study possible for me.*

I thank ***Dr. Guhan, MD, DM,*** *Director,* ***Dr. Karthikesh, Mch, Dr. Bhargavi, Mch,*** *Surgical Oncologists, Sri Ramakrishna Institute of Oncology for their guidance and constant encouragement throughout the study.*

I sincerely thank my teacher ***Dr.M.S.Senthilkumar, M.D.S.,*** *Reader Department of Oral and Maxillofacial Surgery, Sri Ramakrishna Dental College and Hospital, Coimbatore for constant support and encouragement throughout my course.*

I am greatful to my teachers ***Dr. M.A.I.Munshi, M.D.S.,*** ***Dr. R.S.Karthik, M.D.S.,*** *Senior Lecturers, Department of Oral and Maxillofacial Surgery, Sri Ramakrishna Dental College and Hospital, Coimbatore, for their everlasting guidance, cooperation and support throughout my course.*

I am thankful to ***Dr. Vasista*** *and* ***Dr. Sundari****, Anesthetists, Sri Ramakrishna Hospital, for their help rendered towards this study.*

I express my gratitude and heartfelt thanks to ***Dr.V.Prabhakar, M.D.S.,*** *Principal, Sri Ramakrishna Dental College and Hospital, Coimbatore, for giving me an opportunity to utilize the facilities in the institution for the study.*

My Heartfelt thanks goes to my batch mate ***Dr.Naveena,*** *my senior and junior postgraduates who stood by me throughout my course and for their valuable help.*

At personal front, I express special thanks to my parents, wife and children for their innumerable sacrifice, love, understanding and support towards me.

Above all I thank the almighty god for showering his blessings and love on me which has provided me the inspiration and zest to tread the path of the life.

CONTENTS

S.NO.	TITLE	PAGE NO.
1.	INTRODUCTION	6
2.	AIMS AND OBJECTIVES	9
3.	REVIEW OF LITERATURE	11
4.	MATERIALS AND METHODS	39
5.	RESULTS	61
6.	DISCUSSION	83
7.	SUMMARY & CONCLUSION	96
8.	BIBLIOGRAPHY	99

ABSTRACT

AIM

Pectoralis major myocutaneous flap is a versatile flap and used in head and neck reconstruction for ablative tumor surgery. This study is aimed to evaluate the Functional outcome, aesthetic outcome, and recipient & donor site morbidity after Pectoralis Major Myocutaneous flap reconstruction in Oral & Maxillofacial region.

METHODOLOGY

The data of 20 cases of pectoralis major flap for reconstruction of post cancer resection defects of the oral & maxillofacial regions were analyzed. All data concerning functional outcome, aesthetic outcome, site of tumours, types of defects, donor site and recipient site complications and surgical treatment of these patients with pectoralis major myocutaneous flap for reconstruction were analyzed in the follow up period at first week, first month, third month, sixth month and ninth months.

RESULT

In patients who underwent pectoralis major myocutaneous flap reconstruction for oncological resection males (64.7%) were affected more commonly than female, mostly in the age of 40-60 (53.0%) years, the left side (52.9%) of the oral cavity is more commonly affected than the right side, and the alveolus (35.3%) is the most commonly affected site . T2 (47%) size lesion was more common and 52.9% had systemic disease. The results showed significant improvement in the speech, oral spintcher function, tolerance of full diet and satisfactory aesthetic outcome at the end of nine month follow up period. In donor and recipient site complications there was one case of total flap loss with reconstruction plate exposure which had a significant association with ischemic heart disease. In 2/4 patients with T4 lesion, there was significant association with fistula. In 6% patient had wound dehiscence, 11.8% had

partial flap necrosis, 11.7% had implant infection, 17.7% had reconstruction plate exposure and 15% patient died of unknown cause within three months after reconstructive surgery, it was not due to flap related complications.

CONCLUSION

The pectoralis major myocutaneous flap is a major flap for reconstruction of large head and neck defects. The results proved that the flap its continual usage in T3, T4 patients and provides better functional, aesthetic and less donor and recipient site complications.

KEY WORDS:

pectoralis major, reconstruction, function, aesthetic

INTRODUCTION

Reconstruction of any tissue defect poses a unique challenge to the surgeon especially after a more ablative surgery in the head and neck region. When a local tissue cannot cover a Head and neck defect, the surgeon has to seek a distant tissue for reconstruction. The choice lies between a pedicled and free tissue transfer. Free tissue transfer involves micro vascular anastomosis, which requires expertise and facilities. Reconstructive surgeon therefore has to often settle for the use of pedicled flaps to repair defects of head & neck.[1]

The pectoralis major myocutaneous flap is the most commonly employed pedicled flap for the reconstruction of tumor and trauma-related defects in the oral and maxillofacial region.[2] The pectoralis major myocutaneous flap is an axial pattern flap, which means that it is based on a dominant vascular supply that runs axially along the length of the muscle. The skin in such flaps receives its blood supply from perforating vessels of the axial artery system.[19]

The pectoralis major myocutaneous flap was described by Hueston and McConchie in 1968 for reconstruction of a large midline chest wall defect.[19,41] The concept of a pectoralis major island flap was introduced by Brown in 1977. The pectoralis major myocutaneous flap was introduced into head and neck reconstruction by Ariyan in 1979.[6] Ariyan extensively used pectoralis major myocutan flap in reconstruction of oropharynx, the cervicofacial

region, the orofacial complex, the orbit and the temporal region. This experience led surgeons to consider the pectoralis major myocutaneous flap as the gold standard for head and neck reconstruction. This flap was thought to be more versatile than the deltopectoral flap that had enjoyed widespread use up to that point.[31]

Nowadays, free flaps are more common due to improved microsurgical techniques, esthetic and early functional results.[18] Since most patients in our country report only when the disease is in the advanced stage where follow up and prognosis is poor .In medically compromised patients free flap is not ideal due to increased donor site morbidity and high cost involved with salvage surgery if required later. But in several cases the pectoralis major myocutaneous flap still has its advantages, including its proximity to the head and neck, the simplicity of harvesting, and its use as an alternative when microsurgical flap failure occurs.[4] For cases like coverage of a reconstruction plate and carotid artery, the bulkiness of the flap can be an advantage. The pectoralis major myocutaneous flap is characterized by a simple procedure and a short time to harvest.[19]

Disadvantages include reduced neck mobility and the need to rotate the vascular pedicle of the flap 180° when using the skin paddle to resurface the neck. Another disadvantage can be the thickness of the flap, which is determined by the amount of subcutaneous fat between the pectoralis muscle and the overlying skin paddle, leading to possible reduced swallowing or

speech function. Complications such as partial or complete flap necrosis, fistula formation, dehiscence, infection, hematoma and complications in patients after radiotherapy have been described earlier. The complication rate seems to be higher than in free flap reconstructions. Several issues related to the development of the pectoralis major myocutaneous flap should be considered preoperatively. These issues include the timing of flap development, the arc of rotation of the flap, the size of the recipient defect, the color match of the skin paddle and the recipient tissue bed and the potential trauma to the thoracoacromial axis.[7]

AIMS AND OBJECTIVES

The purpose of this study is to

- Evaluate the Functional outcome with Pectoralis Major Myocutaneous flap in Oral & Maxillofacial Reconstruction
- Evaluate the Esthetic outcome with Pectoralis Major Myocutaneous flap in Oral & Maxillofacial Reconstruction
- To evaluate the Recipient & Donor site morbidity after Pectoralis Major Myocutaneous flap reconstruction in Oral & Maxillofacial region

SURGICAL ANATOMY

The pectoralis major muscle is a broad, flat, fan shaped muscle that covers the pectoralis minor, subclavius, serratus anterior and intercostal muscles on the anterior thoracic wall. Its origination is the medial one half to two thirds of the clavicle, the lateral portion of the entire sternum and the adjacent cartilages of the first six ribs and the bony portions of the fourth, fifth and sixth ribs. The blood supply to this muscle includes the pectoral branch of the thoracoacromial artery, the lateral thoracic artery, the superior thoracic artery and the intercostal artery. Three major segmental subunits have been described, including a clavicular segment, a sternocostal segment and a laterally placed external segment. Each has its own vascular and motor nerve

supply. The clavicular segment arises from the clavicular area, receives its blood supply from the deltoid branch of the thoracoacromial artery and is innervated by branches of the lateral pectoral nerve. The sternocostal segment accounts for most of the pectoralis major muscle mass and receives its blood supply from the pectoral branch of the thoracoacromial artery. This segment receives motor innervation from the lateral pectoral and the medial pectoral nerves. The external segment is innervated by the branches of the medial pectoral nerve and has a variable blood supply, with the lateral thoracic artery the exclusive source in 49% of cases. In 18% of cases, the external segment is supplied by branches of the pectoral branch of the thoracoacromial artery; rest of the 33% of cases is supplied by a combination of the lateral thoracic artery and the thoracoacromial artery. The motor action of the pectoralis major muscle is to rotate medially and adduct the humerus. The development of the myocutaneous flap is generally well tolerated, because the latissimusdorsi muscle compensates for otherwise lost adductor activity.[19]

REVIEW OF LITERATURE

Ariyan S (1979)[6] was the first person to apply the principles of pectoralis major muscle for the reconstruction of head and neck defects. In his study, with 14 cases of Pectoralis major myocutaneous flap found that the flap is reliable for repair of defects after ablative surgery in head & neck region and can be transferred immediately.

R T Gregor (1982)[24] analysed the use of pectoralis major myocutaneous island flap, for reconstruction in head and neck surgery. He explained there are two types of cutaneous blood supply: direct vessels and musculocutaneous vessels. He advocated the paddle should be situated medial to the nipple, but may include the nipple if this is essential. It should lie along the acromio-xiphisternal line. He discussed the disadvantage as the skin used is usually hair-bearing in men and the bulkiness of the muscle may be undesirable in certain cases, especially in muscular males; however the muscle can usually be trimmed to fit the defect but it should not be smaller than the skin paddle.

Weaver AW et al (1982)[56] designed the bilobular or gemini type of pectoralis major myocutaneous flap to simplify the closure of large surgical defects of both mucosa and skin that could not be satisfactorily closed primarily. The mucosal and skin defects are closed by two skin paddles supported by a single muscular vascular pedicle. In this design the skin

paddles are fashioned side by side and separated from each other as the muscle is folded between them parallel to the vascular axis. All of the defects were successfully closed with this technique and the major portion of all grafts survived. This design permits single-stage reconstruction after ablation of tumors or treatment of complications which produced large through-and-through muco-cutaneous defects of the head and neck area.

Berktold RE et al (1986)[9] developed a simple, single-stage, primary procedure for chin reconstruction. It is based on a simple modification of the pectoralis major myocutaneous flap with seven cases, including two with total chin reconstructions. The number and type of complication was low and consistent with the magnitude of the surgical procedure. This technique provided acceptable aesthetic and functional results to patients undergoing partial or total resection of the chin.

ROBERT E et al (1990)[48] made an improved technique for the development of the Pectoralis Major Myocutaneous Flap. The modifications introduced in this approach to the pectoralis major myocutaneous flap are based on the known vascular supply to this surgical area and sound principles of flap development and rotation. When flap elevation normally there is a severe restriction due to the muscle insertion on the humerus. All or most of this insertion should be divided just medial to the axilla. This maneuver extends the arc of rotation by about 8 cm cephalad. The technique described in this report usually maintains all three axial vessels of the pectoralis muscle and

suspect that the flap development increases the perfusion pressure in the anatomic vascular territory of the flap itself and decreases the perfusion pressure in the adjacent territory. These modifications of the basic approach to developing a pectoralis major myocutaneous flap have resulted in a more predictable transfer of tissue in even heavily irradiated areas. This technique produced fewer complications and less residual deficiencies and being more cosmetic for the patient.

L E Loh (1992)[30] compared two modalities of treatment in the case of buccal carcinoma. In one case reconstruction was done by using pectoralis major flap by turning it externally to provide skin coverage for the cheek defect. In other case pectoralis major flap was turned internally to repair the buccal mucosal defect and cervicopectoral advancement flap to repair the cheek skin defect. Of the several modalities of reconstruction available the author feels that two modalities are promising.

S Nagral et al (1992)[38] reported their experience with the pectoralis major myocutaneous flap for head and neck reconstruction in a general surgical unit**.** A tube Pectoralis major myocutaneous flaps was used to reconstruct the pharynx and the cervical esophagus. Cosmetically, the donor site scar is totally hidden by clothing; the functional loss is negligible. The flap was employed before or subsequent to the use of chemotherapy or radiotherapy. Disadvantages of the flap include excessive bulk in obese or

muscular individuals and troublesome hair growth in the oral cavity. The final functional and cosmetic results were satisfactory.

Richard Crosher, Roy Mitchell, John Llewelyn (1995)[45] described a modification of the pectoralis major myocutaneous flap that provide sizeable skin paddle and allows a primary closure of the chest wound with good cosmetic results. Here the incision is made along the lower limb of the deltopectoral flap and continues into the crescentic shaped skin paddle. The myocutaneous flap is then raised in the conventional manner and transferred to reconstruct the primary defect. With this technique there is minimal distortion of the breast and the nipple and can be positioned at the same level as the opposite side with good cosmetic results.

Robert A Ord (1996)[41] analysed the reliability and complication of pectoralis major myocutaneous flap in oral & maxillofacial reconstruction with respect to reconstruction of post cancer resection defects of the oral cavity & maxillofacial region. In his technique of flap elevation electric cautery was not used to coagulate vessels on the paddle to avoid retrograde thrombosis and ties were used even small bleeders. The lateral thoracic artery was incorporated in the flap whenever possible. He concludes that the pectoralis major flap is reliable and remains excellent choice for large soft tissue defects in oral cavity despite increased use of microvascular flap.

Kiyokawa K et al (1998)[29] describe a method that preserves circulation during the preparation of the pectoralis major myocutaneous flap

used in head and neck reconstruction. The major disadvantage of this flap is its poor circulation and consequent partial necrosis. They analyzed the circulation and hemodynamics of the pectoralis major myocutaneous flap (the perforator of the anterior intercostal branch located about 1 to 2 cm medial to the areola in the fourth intercostal space is important), evaluated the safe donor sites in the chest wall for a skin island (the perforator is included on the skin island's central axis), improved the surgical procedure for elevating flaps (for preventing perforator injuries) and devised a means to transfer flaps, thereby increasing the range of the flaps (the transfer route is under the clavicle). Using this technique, the partial or marginal necrosis of the flap caused by circulatory problems was detected only in 5% cases. Using this method, the problems associated with inadequate circulation in the pectoralis major myocutaneous flap were greatly alleviated, thus reconfirming the usefulness of this flap in head and neck reconstruction.

G R Williams et al (2000)[57] reported the surgical technique and the outcome of use of this flap in a patient with poor soft-tissue coverage, following multiple operations for a clavicular fracture complicated by nonunion and infection. In this technique, the vascular pedicle, thoracoacromial artery and axillary artery were identified and the length of the vascular pedicle from the axillary artery to the muscle was measured. The angle of rotation of the flap about its intact clavicular origin was measured before and after division of the acromial branch of the thoracoacromial artery.

The clavicular origin was then incised and the overall length, width and thickness of the muscle as well as the distance from each end of the muscle to the vascular pedicle were measured. The result was that average length of the vascular pedicle from the axillary artery to the pectoralis muscle belly was 5.3 centimeters. The rotational flap was successfully used to reconstruct the defect.

O M Oluwatosin, Abikoye F O, Adegboye V O (2000)[40] in his study raised the flap in conventional way with one skin paddle, which is turned in for lining. The muscle component of the flap is covered with skin graft and claimed in this way donor site morbidity and bulk is reduced. The medial paddle retains the blood supply from the pectoral branch of the acromiothoracic artery and the lateral paddle derives its supply from the lateral thoracic artery. Transferring the pectoralis major as a true island flap with the skin paddle raised as far distally produces an increased pedicle length and greater arc of rotation, which in some patients reach the zygoma and contralateral aspect of lip at the same time.

Liu R, Gullane P, Brown D, Irish J (2001)[31] did a retrospective study on reconstruction procedures using the pectoralis major pedicled flap reconstructions after ablation of oral cancer. In his study 35% were affected by complications such as dehiscence, infection, hematoma, seroma, partial flap failure, total flap failure, fistula and donor site complications. The duration of admission for cases with complications was longer and higher complication rates were associated with salvage procedures in oral cavity reconstructions.

Marco Luigi Castelli et al (2001)[33] made a study on Pectoralis major myocutaneous flap and analyzed complications in difficult patients and found that pectoralis major myocutaneous flap is simple to perform and is suitable for immediate repair of large oral and pharyngeal defects, even in difficult patients with various medical problems known to increase complication rates. Patients who had radiotherapy prior to the operation had no such complication. Despite these problems that were encountered in the first postoperative month, after 3 months all patients were able to eat solid food or to drink without aspiration. They recommend the use of PMMF as a first option in frail patients who had large oro-pharyngo-laryngeal excisions and radical neck dissections and who may require postoperative radiotherapy.

Collin Rol, Prabir K josh, R N Podder (2002)[14] presented a case of 55-year-old lady with trismus and full thickness oral defect exposing upper and lower row of teeth diagnosed as cancrum oris. The operative intervention consisted of radical excision of scar tissue, release of bony block of right temporo-mandibular joint ankylosis. The cheek fistula defect was corrected in two layers by bipaddled island pectoralis major myocutaneous flap were the correction of jaw ankylosis and the flap cover was done in a single stage.

A Croce, Moretti, L D'Agostino, Neri G (2003)[16] studied the Continuing validity of pectoralis major muscle flap, 25 years after its first application**.** They concluded, the pectoralis major flap is indicated in patients

who have advance disease, systemic diseases and where micro vascular surgery is contraindicated.

Eric R Carlson (2003)[19] Pectoralis major myocutaneous flap is a reliable and predictable transfer of soft tissue for reconstruction of the patient undergoing tumor ablation or sustaining avulsive trauma. In men, one can transpose a skin paddle of approximately 6 × 6 cm without having to skin graft the chest wall or without significant anatomic distortion of the ventral chest wall following primary closure, when developing a pectoralis major myocutaneous flap. An arteriogram can be obtained if any question exists regarding the integrity of the pedicle. This flap possesses a large volume of vascularized muscle and a skin paddle of sufficient size to satisfy 90% of soft tissue reconstructive needs. Soft tissue flaps of sufficient vascularity will promote healing without complication. He suggests the inclusion of the lateral thoracic artery to the flap is important for flap viability.

Roy L H Ng et al (2003)[49] reported a case of immediate reconstruction of upper and lower lips with mandible using multiple flaps following resection of extensive squamous cell carcinoma. The patient was reconstructed with free fibula osteocutaneous flap, pedicled scalp flap, tongue flap, Palmaris longus tendon sling and pectoralis major myocutaneous flap. At 4 weeks, patient demonstrated good speech and swallowing with an acceptable aesthetic result.

Douglas B et al (2004)[18] evaluated the factors related to surgical complications, rate of gastrostomy tube (G-tube) dependence in patients

undergoing reconstruction with a pectoralis myocutaneous flap against a soft tissue revascularized flap. G-tube dependence is very reliable indication of swallowing function. The minor complication rate was higher in the pectoralis group at 57% than in the revascularized flap group at 21%. The revascularized flaps helped to ameliorate the effects of radiation before surgery; 56% of the patients who received pectoralis flaps were G-tube dependent, while the rate of G-tube dependence in the revascularized flap group was 23%. He concluded that patients who undergo reconstruction with a pectoralis flap have significantly higher minor complication rates, a higher rate of G-tube dependence than patients who undergo reconstruction with a soft-tissue revascularized flap.

M Ethunandan et al (2004)[20] made their important study on Skin necrosis of a pectoralis major myocutaneous flap, caused by methicillin-resistant Staphylococcus aureus, with a bi-paddled pectoralis major myocutaneous flap in which both the pectoral branch of the thoracoacromial artery and the lateral thoracic artery was preserved. They found that the MRSA was colonisation rather than an active infection that would lead to skin necrosis. The main stay of treatment of MRSA infection is vancomycin or teicoplanin or both, though in less severe infections fusidic acid and rifampacin may be used. They suggested when MRSA is isolated, it should be treated early and aggressively with appropriate antibiotics.

Chaudhary A, Wakhlu A (2005)[10] reported a case large paraganglioma arising from right side of the neck and extending to the scalp. The tumor was treated with radical excision and the resultant tissue defect was resurfaced with a pectoralis major flap with split thickness skin graft. There was no recurrence or metastasis with the follow-up for 2years.

M Jog, Meckenzie K, Dempster (2005)[27] reported two cases where metastatic spread at the donor site of the PMMC flap was identified without any apparent persistence or recurrence at the index site. The modes of tumor spread could be due to implantation theory and to prevent this, consideration to extend the radiotherapy field to include the donor site may be given.

Mohammed Tahir, Tahmeedullah, Amir Taimur Khan (2005)[36] did a clinical evaluation of pectoralis major myocutaneous flap in Head and Neck Reconstruction. The infection rate observed in this study was 10%. The significant risk factors for infection were diadetes mellitus and haemoglobin level (less then 10gm %). He also found Oral continence was normal in 5% of patients, occasional drooling in 75% cases and continous drooling in 20% cases and concluded that pectoralis major myocutaneous flap can be used for reconstruction of large Head and Neck defects with acceptable esthetic and functional outcome results.

Aleksandar Milenovic et al (2006)[4] studied the usage of the Pectoralis major flap in head and neck reconstruction in advanced malignant tumor of head & neck and concluded that the pectoralis major myocutaneous

flap is still an acceptable method. Despite the increasing application of microvascular reconstruction, it still has many advantages like it is fast, reliable, provides safe repair and is indicated especially where bulk is needed.

C M E Avery et al (2006)[8] retrospectively studied the use of the pectoralis major flap for advanced and recurrent head and neck malignancy in the medically compromised patient**.** They concluded that the flap retains a major role in the management of advanced primary or recurrent disease, extensive metastatic neck disease and after failure of a free flap when in conjunction with significant co morbidity.

Hamdy-el-marakby (2006)[25] evaluated the Reliability of Pectoralis Major Myocutaneous Flap in Head and Neck Reconstruction. The results showed that the flap is usually associated with a high incidence of complications in addition to its large bulk compared with the free fasciocutaneous flaps. The final functional and the aesthetic results are inferior to free flaps in head and neck reconstruction. In pectoralis flap the complications such as wound dehiscence, infection, hematoma, seroma, partial flap failure, total flap failure, fistula and donor site complications may occur. A higher complication rates were associated when the flap was used for reconstruction, in salvage surgical procedures.

Nath S et al (2006)[39] used the pectoralis myocutaneous flap for mandibular reconstruction and concluded that pectoralis myocutaneous flap is still the workhorse in head and neck reconstruction. Their case series had very

few complications and no disability from the loss of the flap. Locally the donor defect can be primarily closed and recommended the Pectoralis major osteomusculocutaneous flap for reconstructing mandibular defects and suggested reconstruction of the soft palate, floor of the mouth and lateral pharyngeal wall defects with this flap is also possible.

P B Mariani (2006)[34] evaluated the mandibular reconstruction by means of reconstructive plates and myocutaneous flaps. He concluded that mandibular reconstruction plates are effective for the reconstruction of lateral and small defects and are not effective in bridging large defects. He claimed that early radiation therapy may have some influence on loss of the reconstruction plate, because it can compromise the healing process of the pectoralis major flap. The ideal time to start postoperative radiotherapy is within 6 to 8 weeks postoperatively after reconstruction. In non radiated patients after benign tumor resection, with a steel prosthesis, there was an increase of the dose on the external site of the plate and a decrease on the internal side when mean dose of 50 Gy was applied. The Titanium is a more suitable material when a radiation therapy is required as complications were less severe than with stainless steel plates as it showed less modification of dose on either side. He also recommended that the stabilization of the reconstruction plate in the mandible must be carried out with atleast 3 screws in each reminiscent side for correct plate banding to provide a good aesthetic

result and not compress the myocutaneous flap causing ischemia and wound dehiscence.

Po-Wing Yuen (2006)[44] did a study on Preservation of lateral thoracic artery to improve vascular supply of distal skin without compromising pedicle length in harvesting pectoralis major myocutaneous flap. The pectoralis major myocutaneous flap is supplied by three arterial systems. This simple technique preserves the lateral thoracic artery without compromising the pedicle length of the Pectoralis major flap. The lateral thoracic artery is usually seen coming out underneath the lateral border of the pectoralis minor muscle. The pectoralis minor muscle overlying the lateral thoracic artery can be divided completely to release the lateral thoracic artery up to the clavicle. Both the lateral thoracic artery and the pectoral branch of the thoracoacromial artery will have the same centre of rotation on the clavicle. There is no compromise of the pedicle length with this technique. There was no flap loss and it is a recommended technique to improve the blood supply to the distal skin of Pectoralis major flap.

O Goktas et al (2007)[23] used a pectoralis major myocutaneous flap to close the defect after achieving tumor-free resection margins in parotid surgery. They discussed treating previously irradiated malignant salivary gland tumors and repeated irradiation or chemotherapy with palliative intent patient possibility, as Pectoralis flap provides a reconstructive option of performing complex surgical procedures.

Anna Karinne et al (2007)[5] made a study on analysis of Swallowing after retromolar or oropharynx Resection and Reconstruction with Myocutaneous or Microvascular Free Flaps. Microvascular free flaps present low rate of postoperative complication, allowing early beginning to speech swallowing and functional rehabilitation process but needs high specialized surgical team to perform it. The dysphagia severity level was evaluated as bad for the two groups when surgical resection was extended to 2 or 3 adjacent structures. In free flap group, patients with three or more adjacent structures resected presented no function and swallowing difficulties. When pharynx, tongue base or soft palate resection was associated with primary lesion dysphagia severity was more. The final results of oropharyngeal swallowing after retromolar or oropharyngeal cancer surgery seem to differ depending on the type of reconstruction. Microvascular free flaps seemed to allow a more efficient oropharyngeal deglutition.

Hao Zou, DD Sin et al (2007)[26] conducted study on salvage reconstruction of extensive recurrent oral cancer defects with the pectoralis major myocutaneous flap**.** Fourteen flaps were used for mucosal lining of the mouth and 10 flaps were used for reconstruction of the cutaneous defects. The reconstruction of the base of the tongue, the floor of the mouth and the oropharynx emerged as a significant risk factor for flap necrosis. The major complications correlated with the site of reconstruction and from salvage

surgery, survival rate was increased to 2 to 4 years postoperatively in some patients.

P Salvatori (2007)[51] studied the locking-screw titanium plates and pedicled pectoralis major myocutaneous flaps as a valid alternative to complex reconstruction with bony free flaps in poor prognosis or poor performance status oncological patients with mandibular defects. He explain the use of the pedicled flap was necessary to obliterate the dead space under the newly-reconstructed bony arch due to the risk of infection and fistulas in the immediate post-operative period and scar retraction with distortion of the newly reconstructed mandible in the later post-operative period. In more lateral/posterior defects, in older and patients with poor general conditions he advocate to perform pedicled flap or myocutaneous free flap in association with a reconstructive plate, if dentition is present. He also suggests for partial glossectomy patients with resection of the floor of the mouth, a simultaneous fascio-cutaneous free flap is the better choice. Most patients with myocutaneous free flap in association with a reconstructive plate considered the aesthetic outcome acceptable, however all edentulous patients complained of unsatisfactory dental rehabilitation. From the acceptable success rate, it may be concluded that bridging plates represent a useful reconstruction method, provided they are well covered by viable muscular tissue. They should be offered to patients contraindicated for more invasive procedures or with limited functional needs or poor prognosis.

Vicente A Resto et al (2007)[54] reported their experience with the pectoralis major myocutaneous flap for the reconstruction of composite lateral temporal bone defects extending beyond the temporal line. Complete healing of the reconstructed surgical defect with no flap loss was achieved in all cases. It concluded that with specific technical modifications, the pectoralis major myocutaneous flap can be reliably used for the reconstruction of composite lateral skull base defects extending up to and beyond the temporal line, making this flap an important alternative to free flap reconstruction in selected cases.

Ahmed F El-Kased et al (2007)[2] studied the use of the Pectoralis major myocutaneous flap for oral cavity Reconstruction in females and difficult cases requiring double island flaps and concluded that pectoralis major flap is still an acceptable method and has advantages in spite of increasing application of free flaps. He concluded that Pectoralis major myocutaneous flap in females is safe when using the breast sparing medially based skin paddle

Abid H Ahmad S, Warraich R A (2008)[1] evaluated the outcomes of this myocutaneous flaps in term of survival, complications, donor site morbidity, primary closure and chest expansion and shoulder movements. He concluded that Pectoralis major myocutaneous flap cannot only provide skin and mucosal cover simultaneously but also provide adequate muscle cover for through and through defects. It doesn't cause any hindrance in mandibular

movements when used over mandibular reconstruction plate. Its arc of rotation limits its use only for the defects below zygomatic arch and inferior orbital rim and donor site is closed mostly by primary closure, with minimum morbidity.

Asong M (2008)[3] defined the operational indications for using PMMF in head and neck defect reconstruction and summarized how to further increase the success rate. The reconstruction size ranged from 15 cm x 12 cm to 8 cm x 5 cm. His results showed that no morbidity during operation. The success rate of reconstruction was 95.5%. Postoperative complications occurred in 2 (9.1%) patients and concluded that pectoralis major myocutaneous flap is a good donor for head and neck reconstruction.

Corten E M L (2008)[15] evaluated the possibilities of Pectoralis muscle-preservation methods, by transferring one segment of this muscle to reduce donor-site morbidity through microvascular transfer. The nerve supply to the clavicular part of the pectoralis major muscle was investigated in order to maintain its function at the donor site. To determine its feasibility as a segmental microsurgical free flap, the length and diameter of the vascular pedicle of the pectoralis major muscle were investigated. A separate nerve innervated the clavicular and upper medial sternocostal parts of the pectoralis major muscle, based on these anatomical findings they proposed a surgical technique for transfer of the pectoralis major island flap through a tunnel in the deltopectoral groove. They advocated that the technique is reliable with clinical results comparable to conventional techniques, in addition to function

preservation at the donor site. They also concluded that the length and arterial diameter of the vascular pedicle of the sternocostal part were sufficient for microvascular anastomosis and the segmental pectoralis major free flap is a useful and justifiable adjunct to the microsurgical armamentarium for flat or wide craniofacial defects.

Rikimaru H, Kiyokawa K, Watanabe K (2009)[46] reported a new method of preparing a pectoralis major myocutaneous flap for a small thin skin paddle with stable blood circulation. A skin paddle is designed just above the third intercostal perforating branch of internal thoracic artery. With this method it is possible to prepare the pectoralis flap using a small thin skin paddle with stable blood circulation. Donor site closure is done by performing a Z-plasty near axilla and advancing the thoracic skin flap to cover the skin defect this Z-plasty preventing scar contracture in axilla after the surgery.

Vijay Ramakrishnan, William Yao, John P Campana (2009)[55] did a study to examine the outcome of the skin paddle survival using pectoralis myocutaneous flaps in reconstruction of the head and neck. The pectoralis major myocutaneous flap has been associated with a notable incidence of distal skin necrosis and flap loss. Total flap loss was not encountered in any patient. The overall major complication rate in myocutaneous flaps was 4% with these cases consisting of significant skin paddle loss. Donor site complications of the chest wall occurred in 6% of cases. Study concluded that Skin paddle necrosis may be minimized by modifying the classic technique of

extending skin flap over the rectus sheath which is the cause for distal skin flap necrosis and the pectoralis major myocutaneous flap remains a valuable reconstructive option in the head and neck.

Y. Mallet et al (2009)[32] compared the free vascularized flap and the pectoralis major pedicled flap options for reconstruction of the tongue. He favored the free soft-tissue transfer for head and neck reconstruction following cancer resection. He was not able to conclude the choice, either free tissue transfer or the pedicled Pectoralis Major Musculocutaneous Flap as the primary option for head and neck reconstruction.

Mohamed A F El-zohairy et al (2009)[35] did a study to evaluate outcomes of mandibular reconstruction using titanium plates covered with a pedicled pectoralis major myocutaneous flap after ablative surgery for locally advanced tumors of the oral cavity. He discussed that the free flaps involves high cost and may not be justified in patients with advanced disease and poor prognosis, or poor performance status. In such cases he advacated simpler mandibular reconstruction using pectoralis major myocutaneous flap and titanium plates usage, providing a good possibility of restoring function, including masticatory function, improving appearance, and thereby improving quality of life. He discussed that the titanium plates/screw do not interfere with planned radiotherapy and have no significant influence on the radiation doses received by surrounding tissues. Early plate exposure has been related to wound breakdown following infection or soft tissue necrosis. Delayed plate

failure is due to sliding of the pectoralis major and uncovering of part of the plate leading to friction with the overlying skin and plate exposure. All patients achieved good functional and acceptable aesthetic outcome. He concluded that Titanium plate and pedicled pectoralis major myocutaneous flap is a safe and reliable option for composite mandibular defects.

C M E Avery et al (2010)[8] made a study on the use of the pectoralis major flap for advanced and recurrent head and neck malignancy in the medically compromised patient**.** Normally lateral segmental defects of the mandible were not reconstructed with a plate because of the high incidence of exposure and infection, which reduces the quality of life with further morbidity. The pectoralis major flap is allowed reasonable function in the context of limited life expectancy due to its bulk. The use of the pectoralis major flap reflects an increasing number of patients presenting with significant co-morbidity and advanced disease. It is the flap of choice for patients compromised by factors like advanced primary or recurrent oral disease and extensive neck disease, following previous major surgery and/or radiotherapy and in conjunction with significant medical co-morbidity.

Fábio Roberto Pinto, Carina Rosa M, Chirstiana M S V (2010)[22] made his study on factors influencing occurrences of complications and the final outcome in Pectoralis major myocutaneous flaps for head and neck reconstruction following cancer resection. He positioned the skin island just medially to the nipple, over the fourth, fifth and sixth intercostal spaces, with

the skin perforator vessels that arise from the intercostal branches of the internal thoracic artery. They suggested that below the seventh rib, the vascular supply for the skin comes from the cutaneous branches of the superior epigastric artery and therefore, when portions of skin beyond this limit are included in the flap, creates an axial flap with a distal random portion, thereby increasing the risk of partial flap necrosis. Data prove that pectoralis major myocutaneous flap tolerate radiotherapy well.

Astrid L Kruse et al (2011)[7] made a study on evaluation of the pectoralis major flap for reconstructive head and neck surgery. The disadvantages can include reduced neck mobility and the need to rotate the vascular pedicle of the flap 180° when using the skin paddle to resurface the neck, the thickness of the flap, which is determined by the amount of subcutaneous fat between the pectoralis muscle and the overlying skin paddle, leading to possible reduced swallowing or speech function. For cases like coverage of a reconstruction plate or coverage of the carotid artery, the bulkiness of pectoralis major flap can be an advantage. The size of the defect that could be covered in men is 6 cm squared without the need of a further skin graft for closure: In females this size can be doubled due to greater redundancy of the female breast. Special attention should be given to the skin paddles in order to incorporate enough perforators but the complication rate should not be underestimated in particular after radiotherapy.

Chih-Yu Hsing et al (2011)[12] made a quality of life analysis comparison between free flap and pectoralis major pedicled flap for reconstruction in oral cavity cancer patients. Microsurgical reconstructions too have potential morbidities, requiring specialized surgical skills and are often lengthy procedures. Complication rate was higher in the pectoralis major myocutaneous flap group. Wound healing problems were more frequently observed in the pedicled flap group when compared with the free flap group. A lower rate of positive margins was found in patients who underwent free flap reconstruction when compared with that of patients who received pectoralis major myocutaneous flap reconstruction but the statistical difference was not significant. Patients who underwent free flap reconstruction reported better average scores than those who underwent pectoralis major myocutaneous flap reconstruction in the speech, shoulder and mood domains.

Firdous khan et al (2011)[21] studied the versatility of the flap in head and neck reconstruction which exceeded its utilization for the oral cavity and in covering a soft tissue defects in the face. Women who underwent pectoralis major myocutaneous flaps had a higher rate of flap necrosis. Pectoralis major myocutaneous flap has been utilized in extensive deep defects that have resulted from resection of stage III- IV cancer. Study concluded that most complications were minor and did not require a second salvage procedure. Despite the use of free flaps, this flap is still considered the mainstay of head

and neck reconstruction. It is fast, reliable, provides safe repair and is indicated especially where bulk is needed.

Parag sahasrabudhe et al (2011)[42] reported their experience of the pectoralis major flap as the treatment modality for post coronary artery bypass sternal wound dehiscence. Unilateral or bilateral pectoralis major muscle flap by the double breasting technique using rectus extension was used in the management of these patients and found that double breasting technique of the pectoralis major muscle flaps with rectus sheath extension is efficient in covering the entire length of the defect and can reduce the morbidity, without affecting the function of the shoulder joint.

Plazak et al (2011)[43] reported a subcutaneous calcification in the pectoralis major flap as late complication after radiotherapy**.** He claims that the aetiological factors for heterotopic tissue calcification are hypercalcemia, ischemia, trauma, inflammatory vascular damage, thereby causing a thickening of the vessel walls and proliferation of intimal, subintimal cells leading to circulatory inefficiency by fibrotic and sclerotic changes of the vessels later.

Sagayaraj et al (2011)[50] studied different methods of raising a pectoralis major myocutaneous flap island flap, to overcome its drawbacks like bulk, flap length and the difficulty of developing this flap in female patients. Three patients had minor complications like margin necrosis and

wound dehiscence, which were managed conservatively. One patient developed orocutaneous fistula, which required secondary suturing. None of our patients had a total necrosis of the flap. They concluded, in institutions where microvascular expertise is not available, island pectoralis major myocutaneous flap can be used as an alternative with results comparable to that of free tissue transfer.

Schneider et al (2011)[52] studied about the Pectoralis major flap usage without the skin and found there is rapid re-epithelialization of the muscle and a satisfactory long-term result. They advocate preparing the vascular pedicle of the Pectoralis major myocutaneous flap like the pedicle of a free flap and claims than a correctly prepared Pectoralis major myocutaneous flap, in a not too fat patient, is not inferior to a free flap. They used the pectoralis major flap only to salvage a free flap complication and with simultaneous free flap for additional soft tissue filler in primary reconstruction of compromised host and for great vessel coverage after radical neck dissection. The authors believes that drawbacks ascribed to the Pectoralis major myocutaneous flap are the consequence of a non-correct harvesting of the flap and can be avoided with some well-known flap modifications, mainly as regards to the vascular pedicle.

Takeshi Wada et al (2011)[53] studied the usefulness of myofascial flap without Skin in contemporary oral and maxillofacial reconstruction. When only myofascial flap was used, the regenerated mucosa seems to allow better

mobility of the intraoral structures compared with the more rigid and less flexible skin. In cases of mandibular reconstruction using a reconstruction plate alone, the pectoralis major flap was wrapped around the reconstruction plate, completely covering it. The axial pattern flaps survived completely and mucosal regeneration progressed favorably. The regenerated mucosa allowed good mobility of the intraoral structures and wearing of a partial denture was possible even when mandibular reconstruction was carried out with only a reconstruction plate. The period between surgery and complete epithelialisation of the grafted myofascia was approximately 2 months, varying with the size of the defect. Final prosthetic reconstruction was possible within 3 months of operation. There were no complications, such as necrosis of the flap, secondary infection, or dehiscence of the wounds.

Chen Xiao - Hong, Zhao Han-Xue, Fang Ju-Gao (2012)[11] made a study to develop a safe and fast method for preparing pectoralis major flap island flaps using preoperative ultrasonography for vessel detection. Ultrasonography was used to mark out the course of the thoracic branches of the thoracoacromial artery, the lower end of this artery perforating from the fascia into the muscles and the largest perforating branch of the fourth or fifth internal mammary artery entering the pectoralis major flap. A line from the lower end of the thoracic branch to the largest perforating branch of the fourth or fifth internal mammary artery, was drawn to determine the axis of the PMMC flap. According to the ultrasonic marks, the distance from lower end

of thoracic branch to the midpoint of the margin of the inferior clavicular was (5.1±1.2) cm. The time from designing to transferring the island flap was significantly shorter. The rate of partial necrosis was less. They claim that the preoperative vessel detection by ultrasonography facilitates easy, fast and safe harvesting of the true PMMC island flap.

Christiana Maria Riberio et al (2012)[13] evaluated the factors that determine complications and influence the final outcome of the reconstructions with Pectoralis major myocutaneous flap in salvage cancer surgery or in salvage reconstruction. Smoking and diabetes had been associated with a higher incidence of complications. Patients with the highest risk of complications were those over 53 years of age and needing reconstruction of the hypopharynx. Successful reconstruction was achieved in 70.8% of the cases and the rate of complications was 62.5%, with three cases of marginal necrosis of the flap, three dehiscence of the operative wound, five cases of necrosis of up to 40% of the flap and two cases of necrosis beyond 40% of the flap. The preservation of the deltopectoral flap was taken care during elevation of the pectoralis major myocutaneous flap in order to reserve the flap in the event of failure of the pectoralis major myocutaneous flap. Another important policy is to avoid any situation that could place the viability of the pectoralis major myocutaneous flap at risk such as including random areas in the skin island or placing it outside the area of its perforating vessels. The study concluded that older patients, with hypopharyngeal defects

submitted to previous surgery plus radiation therapy, presented a higher risk of complications and reconstruction failure with pectoralis major myocutaneous flap.

G Montemari A Rocco et al (2012)[37] did a retrospective analysis of hypopharyngeal reconstruction using pectoralis major myofascial flap which is a simple variant of the pectoralis major myocutaneous flap. The absence of the skin paddle makes Pectoralis major myofascial flap thinner, more stretchable and easy to tube, allowing the surgeon to easily create a physiologic thin-walled pharynx with no need for previous flap shape planning. They observed postoperative flap-related complications in 6.7% of cases. Total or partial necrosis did not occur in any case. There were four postoperative deaths and were not related to flap complications. Oral intake started within postoperative 10–12 days, without swallowing problems of liquid or solid food. Postoperative radiotherapy performed in 30 patients was well tolerated. He claimed that pectoralis major myofascial flap is safe one-step procedure with low morbidity and particularly useful for partial hypopharyngeal reconstructions, overcoming the disadvantages of the Pectoralis major myocutaneous flap.

Rithin Suvarna et al (2012)[47] evaluated the reconstruction methods of primary oral squamous cell carcinoma cases. They reported that the Pectoralis major flap was commonly used, followed by free fibular flaps, free forearm radial artery flaps and skin grafting. The study concluded that for a given

surgical defect the reconstruction could be with a combination of different flaps or modification of a single flap which will give esthetics and function with minimum donor site morbidity.[47]

V D Kekatpure et al (2012)[28] conducted a study to evaluate factors affecting the selection of pectoralis major flap in the era of free tissue reconstruction for post ablative head and neck defects and flap associated complications. He found that pectoralis major flap has reliable vascularity and the chances of complete flap loss are reduced. Bipaddled can be used for reconstructing full thickness cheek defects. They indicated that pectoralis major flap can be used in medically compromised patients, free flap salvage surgery, extended neck dissections and providing cover to pharyngeal repair following salvage laryngectomy. They also suggested that pectoralis major flap is a reliable option for head and neck reconstruction and has a major role even in this era of free flaps.

MATERIALS AND METHODS

STUDY DESIGN

The data of 20 cases of pectoralis major flap for reconstruction of post cancer resection defects of the Oral & Maxillofacial regions will be analyzed. All data concerning functional outcome, esthetic outcome, site of tumours, types of defects, donor site, recipient site complications and surgical treatment of these patients with pectoralis major myocutaneous flap for reconstruction were analyzed. All patients were treated at Sri Ramakrishna General Hospital, Coimbatore.

MATERIAL

The records of all patients treated with a Pectoralis major myocutaneous flap between September 2010 to September 2012 in Sri Ramakrishna Hospital were systematically reviewed. Twenty patients with carcinoma of oral cavity having T-2, T-3, T-4 lesion with stage-III, stage-IV disease involving bone or Skin of the maxillofacial region which requires composite resection & reconstruction with pedicled flap were selected. Composite resection and reconstruction with 2.5mm reconstruction plate and pectoralis major myocutaneous flap was done.

INCLUSION CRITERIA

1. Patient who had large oral and maxillofacial defect after oncologic resection which cannot be closed primarily.
2. Patient who needs muscle bulk to cover reconstruction plate after segmental resection of mandible.
3. Extended or salvage radical neck dissections in patients with skin involvement over nodes.
4. Patient who has undergone neo adjuvant & adjuvant radiotherapy.

EXCLUSION CRITERIA

1. If the patient is medically compromised who could not tolerate general anesthesia.
2. A defect that is too large or outside the potential reach of the reconstructive tissue.
3. Very obese patients will have a difficult-to-handle and possibly nonviable skin paddle.
4. Patients with prior chest wall trauma and/or prior chest wall surgery (mastectomy, breast implants, subclavian lines, cardiac pacemaker, etc) may have absent, scarred or poorly vascularized pectoralis major muscle.
5. If the pectoralis major myocutaneous pedicle is damaged.
6. Patient unwilling to undergo data collection procedures.

All the patients are informed as to the nature of the surgical and experimental procedures and consent being obtained before surgery.

PREOPERATIVE INVESTIGATION AND SEQUENCE OF PATIENT CARE

On initial presentation to the department, all patients were evaluated clinically and incisional biopsy was done and sent for histopathological study. Patients were also evaluated with CT scan for the tumor involvement of mandible, masticatory muscles, infra temporal fossa, lymphnodes and skin of the face. All the Patients underwent preoperative hematological investigation. Patient with T4 lesions underwent pre-operative radiotherapy. Abalative and reconstructive procedures were performed in a single stage. The specimen was sent for histopathological study, if it reveals close margins or multiple node involvement, post operative radiotherapy was given at total dose of 60Gy divided into 30 fractions. Post operatively we assessed both the functional and esthetic outcome of Pectoralis Major Myocutaneous Flap reconstruction.

Functional outcome was measured in terms of the quality of speech, oral splinter function and the ability to tolerate a full diet.

Speech was classified as:

1. Normal
2. Easily intelligible (understood without difficulties)
3. Poor but intelligible (understood and difficulties)
4. Unintelligible (impossible to understand even with concentration)

Oral splinter function was classified according to the degree of drooling:

1. Normal (no drooling)
2. Occasional drooling (episodic drooling)
3. Continual drooling (producing considerable inconvenience)

The ability to tolerate a full diet after a major oral reconstruction was considered a major success. Patients were assessed to determine whether:

1. Could tolerate a full diet (no limitations)
2. Could tolerate soft diet (pureed food or fluids)
3. Were dependent on a nasogastric tube/gastrostomy tube (entirely dependent on tube feeding for nutritional support)

Aesthetic outcome was judged by both the patient and the surgeon, in terms of color, contour and form of reconstruction. It is purely subjective. It was classified as:

1. Good
2. Acceptable
3. Poor
4. Failure

The complications associated with Pectoralis Major Myocutaneous Flap reconstruction were categorized into two groups:

1. Donor site complications
    a) Haematoma
    b) Seroma
    c) Wound dehisence
2. Recipient site complications
    a) Partial flap necrosis
    b) Complete flap necrosis
    c) Fistula
    d) Infection
    e) Reconstruction plate exposure

Patient's folders were assigned a numerical reference specific for each case. Clinical examination was performed. Extra oral and intra oral photographs were taken and CT scan evaluation was done. Neo adjuvant radiotherapy and chemotherapy was completed in patients with T4 lesion, stage III and stage IV disease. Pre-operative data forms were completed and placed into patient's case folder. Subsequently the patient was scheduled for composite resection and reconstruction with pectoralis major myocutaneous flap under general anesthesia. Tracheostomy was done for all the patients. Post operatively the patients were given IV antibiotics and analgesics (Inj. stelcef 1.5gm, Inj. Tramadol 50mg). Cleaning and dressing of the donor & recipient

area was done. Vitality of the flap was checked periodically. On post operative period patient underwent clinical examination that included functional assessments, esthetic outcome, donor and recipient site complications. The patient was given follow-up appointments postoperatively on 1st week, 1st month, 6 th month and on 9th month. The discussion criteria's such as Functional assessments under which speech, oral spintcher function, tolerance of full diet, esthetic outcome, donor site complications such as hematoma, seroma, wound dehiscence and recipient site complications such partial flap necrosis, complete necrosis, fistula, implant infection, reconstruction plate exposure were evaluated. Data's were collected and statistically analyzed and compared.

STATISTICAL ANALYSIS

All the categorical variables were analysed using the Chi-squared test and continuous variables using students 't' test. Patients who died with in 90 days of surgery were excluded for the long-term esthetic and functional complication analysis. Statistical significance was defined as $P < 0.05$. Statistical analyses were performed using Statistical Package for the Social Sciences 14.0 (SPSS, Chicago, Illinois, USA).

SURGICAL DEVELOPMENT OF THE PECTORALIS MAJOR MYOCUTANEOUS FLAP

SURFACE MARKINGS OF THE VASCULAR PEDICLE

First, the clavicle, xiphoid, ipsilateral sternal border are identified, and then the size and location of the skin paddle being located at the inferior-medial border of the pectoralis major muscle are marked. The vascular axis is drawn on the skin of the chest (figure 3).

FLAP ELEVATION

The initial incision is made at the lateral part toward the anterior axillary line down to the pectoralis major muscle. The maximum amount of muscle should be harvest, because the larger the muscle volume, the safer the flap due to the increased number of myocutaneous perforators. The inferior, medial and lateral incisions are made through the skin, subcutaneous fat and Pectoralis fascia down to the chest wall (figure 8). An electro cautery is used to divide and elevate the flap. The muscle is elevated inferiorly too superiorly, the pedicle should be identified by palpation and visualization on the deep surface of the muscle (figure 9). The pectoralis major muscle derives its blood supply from the pectoral branch of the thoraco acromial artery and lateral thoracic artery. The thoraco acromial artery divides into four branches: pectoral, acromial, clavicular and deltoid. The lateral thoracic is normally cauterized mainly to achieve length and greater arc of rotation. After

dissection the flap off the chest wall, a subcutaneous tunnel is formed under the skin between neck and the chest and the flap is passed underneath the skin bridge and flap mobilised to the recipient area to close the defect (figure 11). When mandible has to be reconstructed with titanium plate the muscle is used to wrap around the plate from inward to outwards to cover the plate entirely, when the defect is laterally (figure 10). When the defect is medially the muscle is wrapped from outside to inside enclosing the reconstruction plate.

SRI RAMAKRISHNA DENTAL COLLEGE & HOSPITAL

DEPARTMENT OF ORAL AND MAXILLOFACIAL SURGERY

REVIEW PROFORMA

PATIENT NAME: **AGE/SEX:**

IP NO:

DIAGNOSIS:

STAGING:

HAEMATOLOGICAL ASSESMENT:

ADJUVANT THERAPY:

TREATMENT DONE:

FUNCTIONAL ASSESMENTS

SPEECH

	1ST WEEK	**1STMONTH**	**6THMONTH**	**9THMONTH**
NORMAL				
EASILY INTELLIGIBLE				
POOR BUT INTELLIGIBLE				
UNINTELLIGIBLE				

ORAL SPLINTER FUNCTION

	1st WEEK	**1st MONTH**	**6th MONTH**	**9th MONTH**
DEPENDENT ON NASOGASTRIC TUBE				
NORMAL				
OCCASIONAL DROOLING				
CONTINUAL DROOLING				

TOLERANCE OF FULL DIET

	1st WEEK	1st MONTH	6th MONTH	9th MONTH
DEPENDENT ON NASOGASTRIC TUBE				
COULD TOLERATE A FULL DIET				
COULD TOLERATE SOFT DIET				

ESTHETIC OUTCOME

	1st WEEK	1st MONTH	6th MONTH	9th MONTH
GOOD				
ACCEPTABLE				
POOR				
FAILURE				

COMPLICATIONS

	DONOR SITE	**YES/NO**
1.	HAEMATOMA	
2.	SEROMA	
3.	WOUND DEHISCENCE	
	RECIPIENT SITE	
1.	PARTIALFLAP NECROSIS	
2.	COMPLETE NECROSIS	
3.	FISTULA	
4.	IMPLANT INFECTION	
5.	RECONSTRUCTION PLATE EXPOSURE	

FIGURES

Figure 1: Armamentarium–Resection and Reconstruction Kit

Figure 2: Micro Saw and Drill

SURFACE MARKINGS

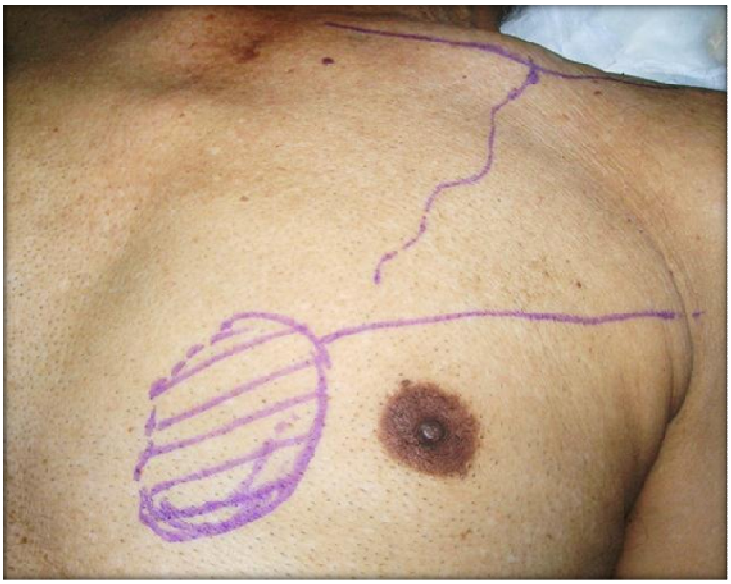


Figure 3: Donor Site Marking

Figure 4: Recipient Site Marking

Figure 5: T4 Lesion

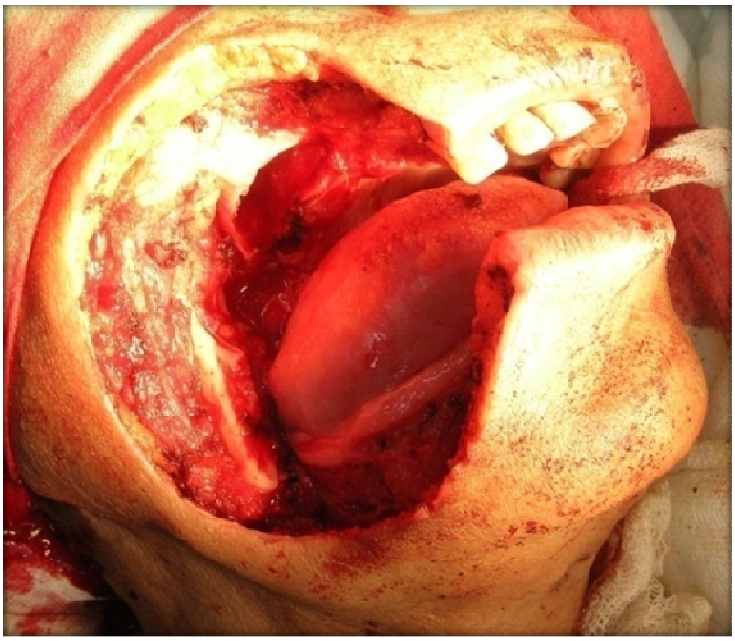


Figure 6: Recipient Site Surgical Defect

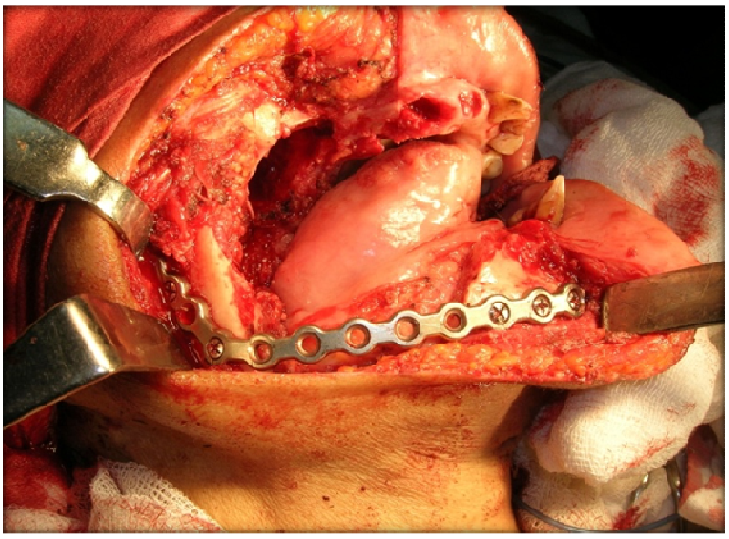


Figure 7: Resection & Reconstruction with Titanium Plate

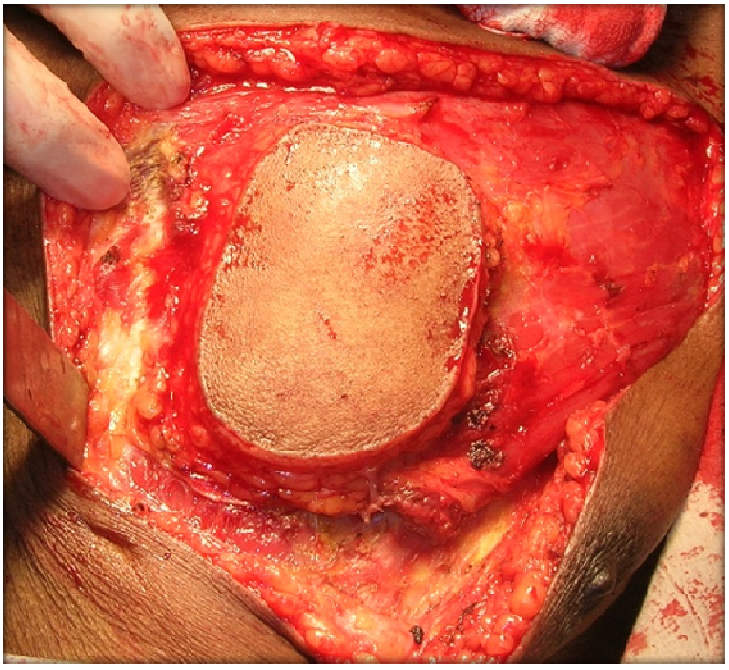


Figure 8: Exposure of Pectoralis Major Muscle with Skin Paddle

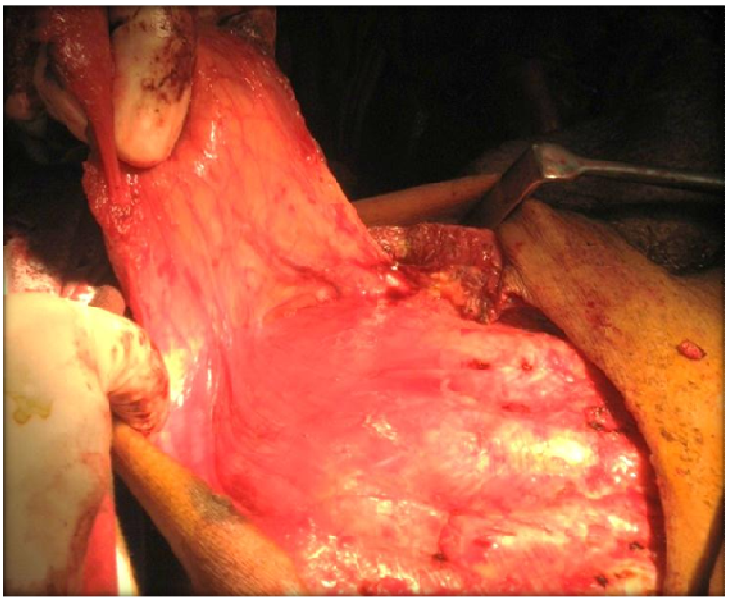


Figure9: Vascular Pedicle Visible On Deep Aspect of PectoralisMajor

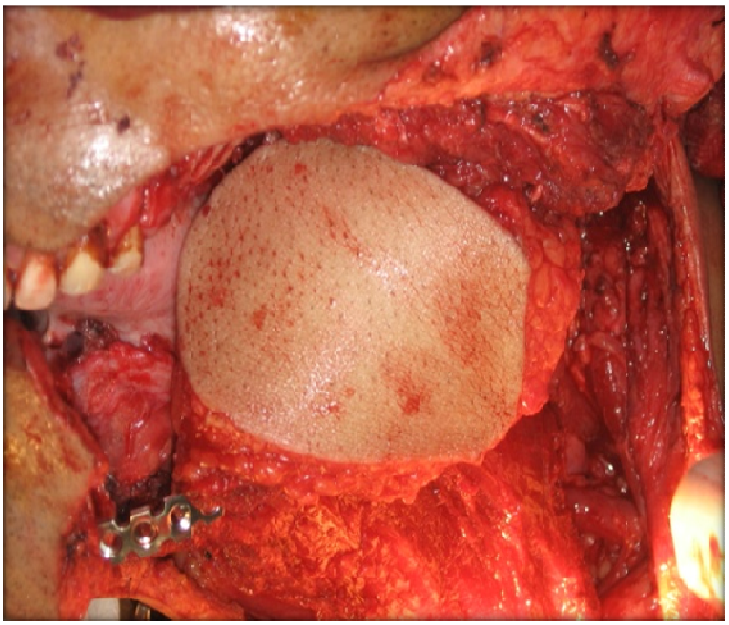


Figure 10: Flap Wrapping the Reconstruction Plate

Figure 11: Reconstruction ofRecipient Site Defect with Reconstruction Plate and Bipaddle Flap

Figure 12: Donor Site Closed Primarily

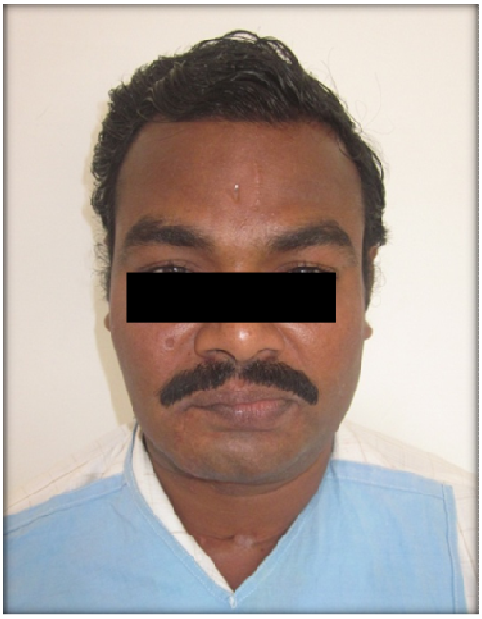


Figure 13: Esthetic out Come- 9th month Post Operative

Figure 14: Donor Site Outcome -9th MonthsPost Operative

Figure15:Flap in situ-9th Month Postoperative

Figure 16: Wound Dehisence

Figure 17: Orocutaneous Fistula

Figure 18: Implant Infection- 3rd month Post Operative Radiograph

Figure 19:Reconstruction Plate Exposure

Figure 20: Total Flap Necrosis with Reconstruction Plate Exposure

RESULT

A two year clinical study was conducted on the functional, esthetic and donor and recipient site complications in 20 patients in whom resection and reconstruction was done with pectoralis major myocutaneous flap from September 2010 to September 2012 in Department of Oral and Maxillofacial Surgery at Sri Ramakrishna Hospital, Coimbatore.

The result of this study are shown under the following sub headings

1. Age and Gender distribution
2. Side of the tumor
3. Site of the lesion
4. Primary T-status
5. History of systemic disease
6. Functional outcome
7. Esthetic outcome
8. Donor and Recipient site complications

Out of 20 patients, 17 patients were taken for analysis as three patients did not survive the study period of 9 months. They were excluded from the results.

AGE AND GENDER DISTRIBUTION

In 17 cases in whom resection and reconstruction was done with pectoralis major myocutaneous flap gender distribution of the study population over two years showed that 64.7% of male were affected compared with 35.3% female. The peak incidence of tumor was noted in patients in 40-60 years of age accounting for 53% cases (Table-2 and 3).

SIDE OF THE LESION

In 17 cases, 52.9% of patients with lesion on the left side and 47.1% on the right side of the oral cavity were resected and reconstructed with pectoralis major myocutaneous flap. There was no significant association between the side of the lesion and associated complications ($P > 0.05$) (Table-4 and 20, graph 2).

SITE OF THE LESION

In 17 cases the lesion were 35.3% in lower alveolus, 23.5% in buccal mucosa, 17.6% in retromolar trigone,11.8% in lateral border of the tongue and 11.8% in floor of the mouth were resected and reconstructed with pectoralis major myocutaneous flap. There is no significant association between the site of the lesion & complications ($P > 0.05$) (Table-5 and 24, graph-1 and 6).

T-SIZE OF THE TUMOR

In 17 cases in whom resection and reconstruction was done with pectoralis major myocutaneous, 12.5% (1/8) patient with T2 status had seroma & wound dehiscence. 20% (1/5) in T3, 25% (1/5) in T4 had partial flap necrosis, 25% (1/4) in T4 status had complete necrosis, 20% (1/5) in T3 status had implant infection 40% (2/5) in T-3 status, 25% (1/4) in T4 status had reconstruction plate exposure.50% (2/4) in T4 status had fistula and Chisquare value for association between T-status with fistula is 7.367 ($P < 0.05$) which is significant (Table-6 and 22, graph 4).

HISTORY OF SYSTEMIC DISEASE

In 17 cases in whom resection and reconstruction was done with pectoralis major myocutaneous flap. 47.1% (8/17) had history of systemic disease in which 29.4% (5/17) had diabetes, 29.4% (5/17) had hypertension and 17.6% (3/17) had ischemic heart disease. There is significant association between ischemic heart disease and complete flap necrosis with Chi square value 4.958 ($P < 0.05$) (Table-7 and 23, graph 5).

FUNCTIONAL OUTCOME

In 17 cases in whom resection and reconstruction was done with pectoralis major myocutaneous flap, at the end of nine months speech was normal in 11.8%, easily intelligible in 70.6%, poor but intelligible in 11.8% and unintelligible in 5.9% of the patients. There is significant improvement in

the quality of speech between initial stage and end of nine months, t - value of 3.405 ($P < 0.05$) (Table-8).

Oral spintcher function was normal in 70.6%, continual drooling in 17.6%, occasional drooling in 5.9% and ryles tube feeding in 5.9% patients. There is improvement in the oral spintcher function at the end of 9 months as t - value of 3.405 for the mean difference in the oral spintcher function between the initial stage and the 9^{th} month is significant ($P < 0.05$) (Table-9).

Tolerance of full diet in 23.5% could tolerate soft diet in 70.6% dependent on nasogastric tube in 5.9%. There is improvement in tolerance of full diet at the end of 9 months, as the t - value of 3.405 for the mean difference in the tolerance of full diet between the initial stage and the 9^{th} month is significant ($P < 0.05$) (Table-10).

AESTHETIC OUT COME

Patient satisfaction on aesthetic outcome is good in 23.5%, acceptable in 52.9% and poor in 23.5% at the 9^{th} month. There was improvement in aesthetics of the recipient and donor site as t - value of 2.384 for the mean difference in the aesthetic outcome between the initial stage and the 9^{th} month is significant ($P < 0.05$) (Table-11).

DONOR & RECIPIENT SITE COMPLICATION

SEROMA

Among 17 cases in whom resection and reconstruction was done with pectoralis major myocutaneous flap 33.3% (1/3) had disease in retromolar trigone, 5.9% (1/8) with T - II status, 9.1%(1/10) patients stage - III 1 out of 8 (12.5%) patients with systemic disease, 1 patients without radiotherapy had seroma. There is no significant association between side, radiotherapy, T-size and systemic disease with seroma (Table-12).

WOUND DEHISCENCE

In our study we found, 33.3% (1/3) had disease in retromolar trigone, 9.1% (1/10) cases in stage III, 5.9% (1/8) cases in T2 status, 12.5% (1/8) of patient with systemic disease, 62.5% (10/16) of patients without radiotherapy had wound dehiscence. There is no significant association between radiotherapy, T-size and systemic disease with wound dehiscence (Table-13).

FISTULA

In our study we found 11.8% (1/ 2) patients with disease in lateral border of the tongue and floor of the mouth, 33.3% (2/6) patient with stage - IV, 50% 25% (2/8) patients with history of systemic disease had fistula. In 50% (2/ 4) patients with T4 status there was significant association with fistula with Chi square value being 7.367 ($P < 0.05$) (Table-14 and 22, Graph-4).

PARTIAL FLAP NECROSIS

In our study we found 50% (1/2) patients in lateral border of the tongue and 16.7% (1/6) patients with carcinoma in alveolus, 9.1% (1/11) patients in stage III and 6.7% (1/6) in stage IV 12.5% (1/8) patient with medical history, 20% (2/10) patients who underwent radiotherapy had partial flap necrosis. There is no significant association between radiotherapy, T-size and systemic disease with partial flap necrosis (Table-15).

COMLETE NECROSIS

In our study we found 50% (1/2) who had disease in floor of the mouth, 16.7% (1/6) in stage IV disease, 25% (1/4) patients with T4 size, 12.5% (1/8) patient with systemic disease, 10% (1/10) who underwent radiotherapy had complete necrosis There is a significant association between ischemic heart disease and complete flap necrosis with Chi square value 4.958 ($P < 0.05$) (Table-16 & 23, Graph-5).

IMPLANT INFECTION

In our study we found 50% (1/2) each who underwent radiotherapy, 50% (1/2) without radiotherapy, 33.3% (1/3) in retromolartrigone,16.7% (1/6) in alveolus, 12.5% (1/8) in T-2 status, 20% (1/5) in T-3status, 12.5% (1/8) with history of systemic disease, 11.1% (1/9) without systemic disease, 12.5% (1/8) on right side, 11.1%(1/9) on left side implant infection. There is no

significant association between radiotherapy, T-size and systemic disease with Implant infection (Table-17).

RECONSTRUCTION PLATE EXPOSURE

In our study we found 30% (3/10) who underwent radiotherapy, 33.3% (2/6) in alveolus, 50%(1/2) in floor of the mouth, 40% (2/5) in T-3, 25% (1/4) in T-4 status,12.5% (1/8) with history of systemic disease, 22.2% (2/9) without systemic disease, 25% (2/8) on right side, 11.1% (1/9) on left side had reconstruction plate exposure. There is no significant association between radiotherapy, T-size and systemic disease with reconstruction plate exposure (Table-18).

MORTALITY

Among 20 cases in whom resection and reconstruction was done with pectoralis major myocutaneous flap three patients died of unknown cause with in 3months of follow up period. It was not due to flap related complications. (Table-19).

Table 2: AGE DISTRIBUTION

AGE	FREQUENCY	PERCENT
20-40 years	3	17.6
40-60 years	9	53.0
Above 60 years	5	29.4

Table 3: SEX DISTRIBUTION

SEX	FREQUENCY	PERCENT
Male	11	64.7
Female	6	35.3
Total	17	100.0

Table 4: SIDE DISTRIBUTION

SIDE	FREQUENCY	PERCENT
Right	8	47.1%
Left	9	52.9%
Total	17	100.0

Table 5: SITE OF LESION DISTRIBUTION

SITE	FREQUENCY	PERCENT
Alveolus	6	35.3
Buccal mucosa	4	23.5
Retromolar trigone	3	17.6
Lateral border of the tongue	2	11.8
Floor of the mouth	2	11.8
Total	17	100.0

Table 6: PRIMARY-T STATUS DISTRIBUTION

STAGE	FREQUENCY	PERCENTAGE
T2	8	47.0
T3	5	30.0
T4	4	23.0
TOTAL	17	100.0

Table 7: SYSTEMIC DISEASE DISTRIBUTION

SYSTEMIC DISEASE	FREQUENCY	PERCENT
NO	9	52.9
YES	8	47.1
TOTAL	17	100

Table 8: MEAN DIFFERENCE IN SPEECH

SPEECH	MEAN	N	STD DEVIATION	t-VALUE	P
1st month	2.1176	17	.60025	4.747	0.01
9th month	2.8824	17	.69663		

P<0.05=SIGNIFICANT

Table 9: MEAN DIFFERENCE IN ORAL SPINTCHER FUNCTION

Oral spintcher function	Mean	N	Std Deviation	t-value	P
1st month	3.0000	17	1.00000	3.405	0.01
9th month	3.5294	17	.87447		

P<0.05=SIGNIFICANT

Table 10: MEAN DIFFERENCE IN TOLERANCE OF DIET

Tolerance of full diet	Mean	N	Std Deviation	t-value	P-value
1st month	1.5882	17	.50730	3.405	0.01
9th month	2.1765	17	0.53859		

P<0.05=SIGNIFICANT

Table 11: MEAN DIFFERENCE IN AESTHETIC OUT COME

Aesthetic out come	Mean	N	Std Deviation	t-value	P-value
1st month	2.5882	17	0.50730	2.384	0.01
9th month	3.0000	17	0.70711		

P<0.05=SIGNIFICANT

Table 12: SEROMA DISTRIBUTION

Seroma	Frequency	Percentage
No	16	94.1
Yes	1	5.9
Total	17	100

Table 13: WOUND DEHISCENCE DISTRIBUTION

Wound Dehiscence	Frequency	Percentage
No	16	94
Yes	1	6
Total	17	100

Table 14: FISTULA DISTRIBUTION

Fistula	Frequency	Percentage
No	15	88.2
Yes	2	11.8
Total	17	100

Table 15: PARTIAL FLAP NECROSIS DISTRIBUTION

Partial Flap Necrosis	Frequency	Percentage
No	15	80.2
Yes	2	11.8
Total	17	100

Table 16: COMPLETE NECROSIS DISTRIBUTION

Complete Necrosis	Frequency	Percentage
No	16	94.1
Yes	1	5.9
Total	17	100

Table 17: IMPLANT INFECTION DISTRIBUTION

Implant Infection	Frequency	Percentage
No	15	88.3
Yes	2	11.7
Total	17	100

Table 18: RECONSTRUCTION PLATE EXPOSURE DISTRIBUTION

Reconstruction Plate Exposure	Frequency	Percentage
No	14	82.3
Yes	3	17.7
Total	17	100

Table 19: MORTALITY RATE

Death	Frequency	Percentage
No	17	85
Yes	3	15
Total	20	100

Table 20: ASSOCIATION BETWEEN SIDE OF THE LESION AND COMPLICATION

COMPLICATIONS	LEFT		RIGHT		CHI-SQUARE VALUE	P-VALUE
	NO	YES	NO	YES		
HEMATOMA	0	0	0	0	a .	
SEROMA	8	1	8	0	0.944	0.331
WOUND DEHISENCE	8	1	8	0	0.944	0.331
FISTULA	8	1	7	1	0.008	0.929
PARTIAL FLAP NECROSIS	9	0	2	6	2.550	0.110
COMPLETE NECROSIS	8	1	8	0	0.944	0.331
IMPLANT INFECTION	8	1	7	1	0.008	0.929
RECONSTRUCTION PLATE EXPOSURE	8	1	6	2	0.562	0.453

Table 21: ASSOCIATION BETWEEN RADIOTHERAPY AND COMPLICATIONS

COMPLICATIONS		RADIOTHERAPY		CHI-SQUARE VALUE	P-VALUE
		NO	YES		
HEMATOMA	NO	0	0	a.	
	YES	0	0		
SEROMA	NO	6	10	1.518	0.218
	YES	1	0		
WOUND DEHISENCE	NO	6	10	1.518	0.218
	YES	1	0		
FISTULA	NO	7	8	1.587	0.208
	YES	0	2		
PATIALFLAP NECROSIS	NO	7	8	1.587	0.208
	YES	0	2		
COMPLETE NECROSIS	NO	7	9	0.744	0.388
	YES	0	1		
IMPLANT INFECTION	NO	6	9	0.073	0.787
	YES	1	1		
RECONSTRUCTION PLATE EXPOSURE	NO	7	7	2.550	0.110
	YES	0	3		

Table 22: ASSOCIATION BETWEEN T-STATUS AND COMPLICATION

COMPLICATIONS	STAGE-III		STAGE-IV		CHI-SQUARE VALUE	P-VALUE
	NO	YES	NO	YES		
HEMATOMA	11	0	6	0	a .	
SEROMA	10	1	6	0	0.580	0.446
WOUND DEHISENCE	10	1	6	0	0.580	0.446
FISTULA	11	0	4	2	4.156	0.041*
PARTIAL FLAP NECROSIS	10	1	5	1	0.215	0.643
COMPLETE NECROSIS	11	0	5	1	1.948	0.163
IMPLANT INFECTION	9	2	6	0	1.236	0.266
RECONSTRUCTION PLATE EXPOSURE	9	2	5	1	0.006	0.938

***P <0.05-SIGNIFICANT**

Table 23: ASSOCIATION BETWEEN SYSTEMIC DISEASE AND DONOR&RECIPIENT SITE COMPLICATIONS

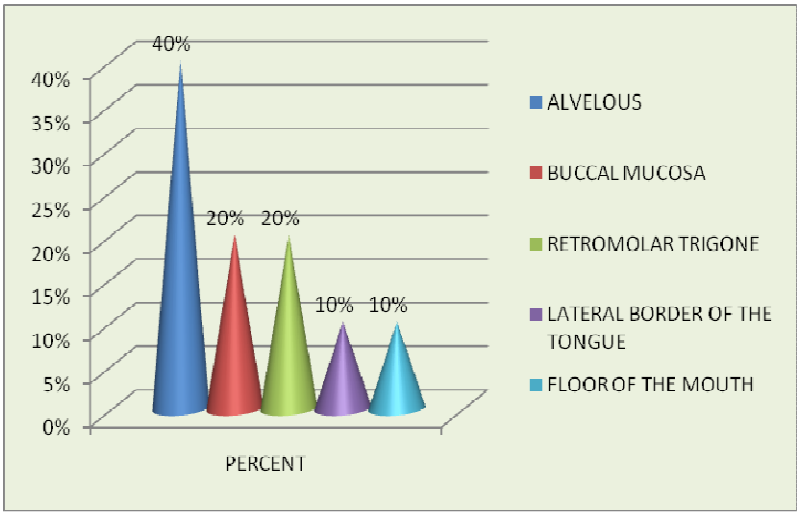
	DIABETES		HYPERTENSION		ISCHEMIC HEART DISEASE		CHI-SQUARE VALUE	P-VALUE
	NO	YES	NO	YES	NO	YES		
HEMATOMA	0	0	0	0	0	0	.[a]	
SEROMA	1	0	1	0	1	0	0.443	0.056
WOUND DEHISENCE	0	1	1	0	1	0	2.550	0.110
FISTULA	1	1	1	1	1	1	0.463	0.496
PARTIAL FLAP NECROSIS	1	1	2	0	2	0	0.463	0.496
COMPLETE NECROSIS	1	0	0	1	0	1	4.958	0.026*
IMPLANT INFECTION	1	1	2	0	2	0	0.463	0.496
RECONSTRUCTION PLATE EXPOSURE	3	0	2	0	2	1	1.518	0.218

*** P <0.05-SIGNIFICANT**

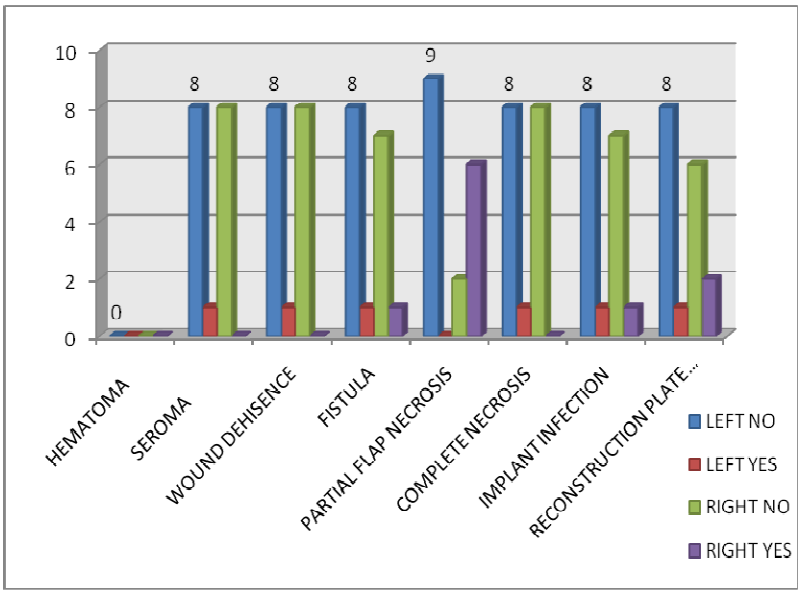
Table 24: ASSOCIATION BETWEEN SITE OF THE LESION AND COMPLICATION

	RETROMLAR TRIGONE		LATERAL BORDER OF TONGUE		ALVEOLUS		BUCCAL MUCOSA		FLOOR OF THE MOUTH		CHI SQUARE VALUE	P VALUE
	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES		
HEMATOMA	0	0	0	0	0	0	0	0	0	0	a.	
SEROMA	2	1	2	0	6	0	4	0	2	0	4.958	0.292
WOUND DEHISENCE	2	1	2	0	6	0	4	0	2	0	4.958	0.292
FISTULA	3	0	1	1	6	0	4	0	1	1	7.367	0.118
PARTIAL FLAP NECROSIS	3	0	1	1	5	1	4	0	2	0	4.156	0.385
COMPLETE NECROSIS	3	0	2	0	6	0	4	0	1	1	7.969	0.093
IMPLANT INFECTION	2	1	2	0	5	1	4	0	2	0	2.550	0.636
RECONSTRUCTION PLATE EXPOSURE	3	0	2	0	4	2	4	0	1	1	4.385	0.356

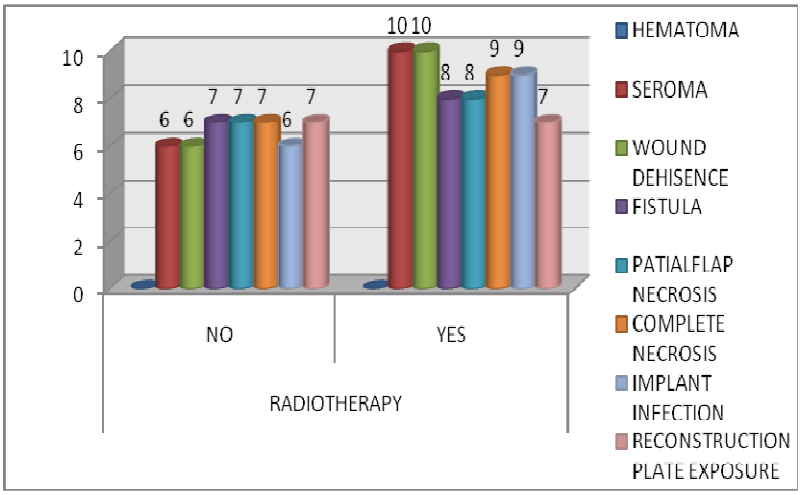
Graph 1: SITE OF LESION DISTRIBUTION



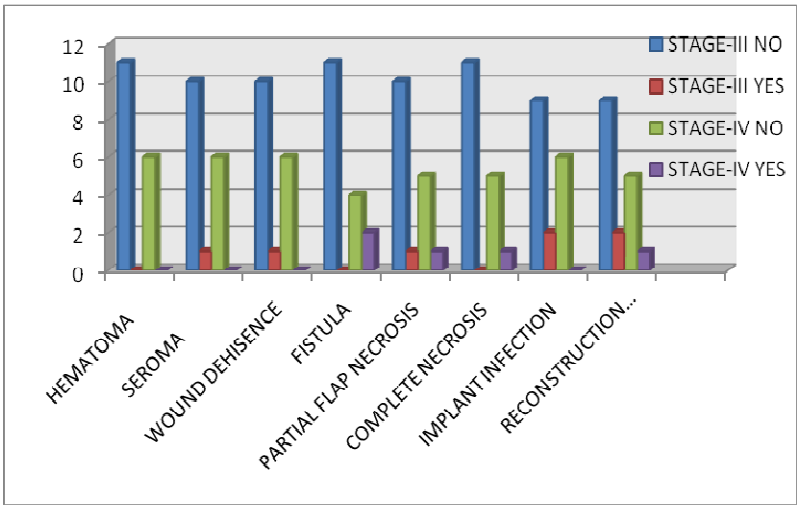
Graph 2: ASSOCIATION BETWEEN SIDE OF THE LESION AND COMPLICATION



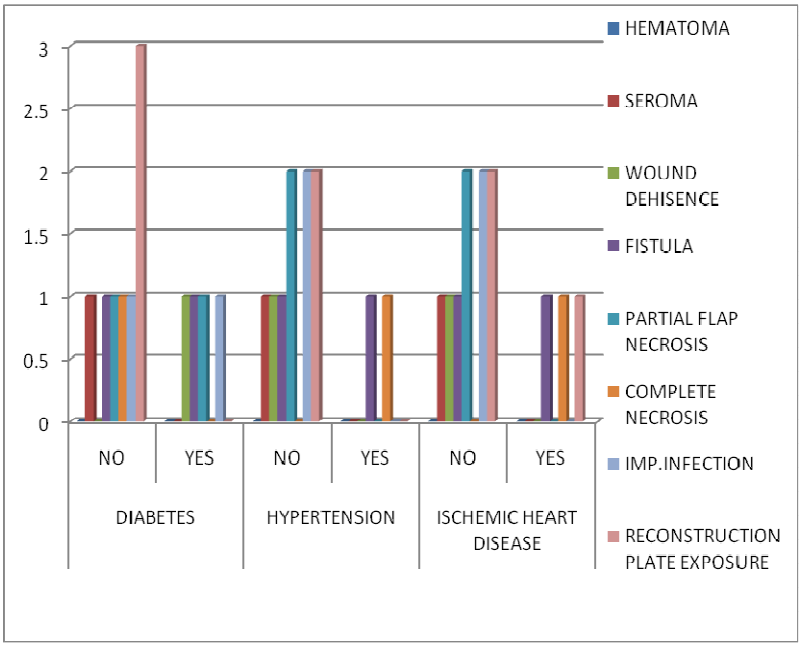
Graph 3: ASSOCIATION BETWEEN RADIOTHERAPY AND COMPLICATIONS



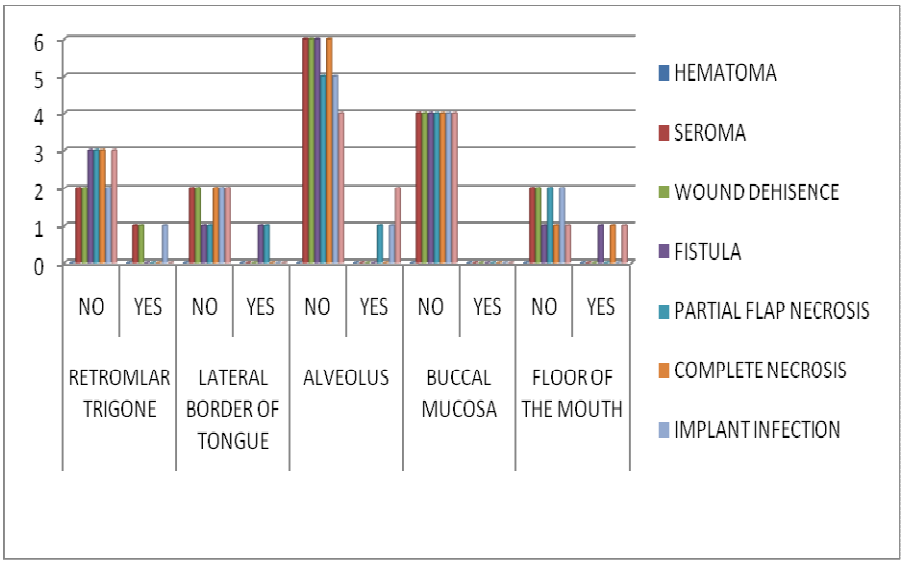
Graph 4: ASSOCIATION BETWEEN T-STATUS AND COMPLICATION



Graph 5: ASSOCIATION BETWEEN SYSTEMIC DISEASE AND ASSOCIATED COMPLICATION



Graph 6: ASSOCIATION BETWEEN SITE OF THE LESION AND COMPLICATION



DISCUSSION

In head and neck region, reconstruction of maxillofacial defects after a ablative cancer surgery is a challenge to the surgeon.[4,26,40] In oncologic surgery, the goal is to achieve tumour-free margins with functional and esthetic restoration, so that the quality of life is as little impaired as possible.[15] The applicability of Pectoralis major flap in head and neck reconstructive surgery have proved to be an advance over previously used flaps such as the deltopectoral flap.[2] All the previous literatures have very well established that pectoralis major myocutaneous flap is a reliable and practical transfer of soft tissue for the reconstruction of extirpative and avulsive defects of the oral cavity and face[32] and continued to enjoy as the main reconstructive option for a variety of reasons including preference, costs and lack of expertise in free flaps.[5,35] The flap elevation procedure is simple and shows predictable results when the scientific principles of myocutaneous flap surgery are adhered. Sufficient evidence substantiates the numerous indications, diverse applicability, techniques and great versatility of this soft tissue flap. Recent concepts of micro vascular flaps for reconstruction have proven its efficacy in reconstruction on head and neck region not outdating the pectoralis major flap completely due to its usage as secondary flap after free flap failure.[32]

Reconstruction of the soft palate, floor of the mouth and lateral pharyngeal wall can also be done with this flap.[43] The pectoralis major myocutaneous flap allowed blood supply to the grafted iliac bone.[8] The

discussion involves various modification of pectoralis major flap. The study also analyses the influence of functional, esthetic outcomes and complications of donor and recipient site with factors like systemic disease, radiotherapy, site, stage of disease and T status influence.[2]

Robert E. Marx and Brian R. Smith, 1990 included the lateral thoracic artery and showed good reduction in complications, a greater range of use and consistent healing in radiated and non irradiated tissues and not requiring sectioning of the clavicle causing significant chest deformities.[48]

Richard Crosher 1995, described a modification where the incision is made along the lower limb of the deltopectoral flap and continues into the crescentic skin paddle of the pectoralis that provides a sizeable skin paddle and allows primary closure of the chest wound with good cosmetic results.[45]

Kiyokawa. K et al, included the third intercostal perforating branch of internal thoracic artery along with the skin paddle which provided the flap a stable blood circulation[29], Anthony Po-Wing Yuen, preserved the lateral thoracic artery by dividing the pectoralis major muscle over the artery at the clavicular part for complete release without compromising pedicle length in harvesting pectoralis major myocutaneous flap.[44]

Rikimaru also preserved the internal thoracic artery but modified the incision which extended to the axilla and a Z- plasty was used to close the donor defecy.[46] Vijay R. Ramakrishnan et al believed that the skin flap over

the rectus sheath is the cause of distal skin flap necrosis and avoided rectus sheath with the skin paddle, also designed the skin paddle within curvilinear incision in males and infra mammary skin paddle in females.[55]

The further modification of the flap includes an osteomyocutaneous variety where the flap is raised along with the anterior part of the fifth or sixth rib to reconstruct the mandible. The final functional and cosmetic results were satisfactory. The pectoralis major myocutaneous flap provided natural mucosa when transferred intra orally.[13] In our study the lateral pedicle of thoracoacromial artery was sacrificed to attain length and greater arc of rotation, holding the basic of the early technique of raising pectoralis major myocutaneous flap with electrocautery dissection.

Astrid L Kruse et al (2011) reported that male to female ratio was 17:3, with a mean age of 60 years.[7,15,16] In our study the male to female ratio was 11:6. In literature the most common type of tumor was squamous cell carcinoma 90%.[26] All the cases in our study were squamous cell carcinoma.

In literature, most commonly the tumor involved area was right mandibular region (66.6%) followed by left mandibular region (22.2%) and right buccal mucosa 11.1%.[16]

In our study left mandibular region (52.9%) was more commonly affected than right mandibular (47.1%) region. The site of involvement in

alveolus was 35.3%, buccal mucosa 23.5% and retromolar area 17.6%, floor of the mouth and lateral border of tongue 11.8% each (Table-5).

The reconstruction of the base of the tongue, the floor of the mouth, and the oropharynx emerged as a significant risk factor for flap necrosis.[26] In our study a patient with carcinoma floor of the mouth had total flap loss. The end of the study didn't show any significant association between site, side of the lesion with donor & recipient site complications ($P > 0.05$).

For primary oral squamous cell carcinoma cases pectoralis major flap was commonly used, thus restoring esthetics and function with minimal donor site morbidity.[16,38,48] Earlier studies showed that speech was normal in 45.4%.[36] In our study at the end of 9 months there is significant improvement in speech ($P < 0.05$), being normal in 11.8%, easily intelligible in 70.6% poor but intelligible in 11.8%, unintelligible in 5.9% patients (Table-8).

In comparison to pectoralis major flap, free flap reconstruction reported better intelligible speech.[5,35]

In literature oral continence was normal in 5% of patients, occasional drooling in 75% cases and continuous drooling in 20% cases.[16,19,36]

In our study at end of 9 months there is significant improvement in oral sphincter function ($P < 0.05$) being normal in 70.6%, continual drooling in 17.6%, occasional drooling in 5.9%, patients (Table-9).

Early studies showed, 54.5% was able to tolerate full diet, 27.3% were able to tolerate soft diet and dependant on nasogastric tube was in 18.2% of cases on pectoralis major flap reconstruction.[36]

In our study, there was significant improvement in tolerance of full diet in 23.5% and 5.9% patients were nasogastric tube dependent at the end of 9 months (Table-10).

The thickness of the flap in obese and muscular individuals, which is determined by the amount of subcutaneous fat between the pectoralis muscle and the overlying skin paddle, leads to reduced swallowing or speech function.[5,7,35,33,35]

Mohammed Tahir et al showed 15% had good result; majority had acceptable result 60%, poor result in15% patients in his analysis on esthetic outcome on patients who had under gone pectoralis major flap reconstruction.[36]

In our study esthetic outcome was good in 23.5%, acceptable in 52.9%, poor in 23.5% and there was marked improvement in the esthetic outcome in patients reconstructed with Pectoralis major flap (Table-11).

The large bulk of the flap reduced neck mobility and needed the vascular pedicle of the flap to rotate 180° when the skin paddle is used to resurface the neck.[7] The resection of the pedicle, even a few weeks after transplant, together with the subclavicular passage, may avoid the majority of

the well-known functional and esthetic problems related to this reparative technique.[40] In mandibular reconstruction by means of reconstructive plates and myocutaneous flaps, reconstruction plates should be stabilized with atleast 3 screws in each reminiscent side for correct plate banding to provide a good aesthetic result.[34,35] Aesthetic results are improved at the harvesting site in males in whom the thoracic skin can be re-sutured without any tension cervical mobility and obtaining a good appearance of the neck and decreasing the traction downwards of the flap.[57]

Common complications cited in donor & recipient site after Pectoralis major myocutaneous flap reconstruction are, haematoma, seroma, wound dehiscence, fistula, implant infection, reconstruction plate exposure and total or partial skin necrosis secondary to vascular compromise.[55]

In literature overall success rate ranged from 70.8% to 95.5%.[16,38,48] The overall complications ranged from 6% to 63%.[18,25,37] The overall complication rate in our study was 5.8% .

The total loss of flap ranged from 2% to 6%.[19,22,30,31,36,43] In our study complete necrosis was in 5.9% (Table-16). At the recipient site, rough handling of a very small skin paddle (2 x 3 cm) seemed to be responsible for the totally necrosed skin paddle and extensive peripheral vascular disease with postoperative hypotension seemed to be the major factor in the only partially necrotic skin paddle.[3] There is a significant association between ischemic

heart disease and complete flap necrosis with chi square value 4.958 ($P < 0.05$).

When total flap loss is realized, resurrection of the flap is impossible even when hyperbaric oxygen therapy is administered.[2] The lateral thoracic artery's contribution to the flap is most important for flap viability,[19,44] but in our study we didn't include lateral thoracic artery. There was one total flap loss case in our study.

Partial flap loss ranged from 3.3% to 32%.[2,19,21,22,30,36,43] In our study partial flap necrosis was in 11.8% of cases (Table-15). The most difficult complication of a pectoralis major myocutaneous flap is partial or total flap necrosis. This complication requires additional surgery to attempt salvage of the reconstruction.

The possible cause for flap loss could be the variations in vascular supply or a possible technical error while harvesting the flap, like skin paddle beyond the seventh rib, external compression caused by the tracheostomy cannula strap.[21] Skin paddle away from the area of the main skin perforating vessels that arise from the intercostal branches of the internal thoracic artery and small skin paddle which did not encompass sufficient skin perforating vessels are also the reasons for partial or total flap loss.[40]

Fistula complication in head and neck surgery cases reconstructed with pectoralis major muscle ranged from 2% to 45%.[2,21,30,35,36,43] In our study

fistula was in 11.8% cases (Table-14). There was significant association between patients with T4 status and fistula with Chi square value being 7.367 (Table-22).

The oro-cutaneous fistulas may be avoided by elevating a slightly larger cutaneous island which allows tension-free suture of the flap to the oropharyngeal excision margins.

Wound dehiscence after reconstruction ranged from 5.2%-26%.[25,19,21,35] In our study wound dehiscence were in 6% of cases. (Table-13)

There is no significant association between wound dehiscence and radiotherapy, systemic disease and T-size of the disease. A tension free closure could have allowed and compensated for fibrosis and contracture.

Accumulation of hematoma ranged from 5.4% to 7%[8,12,19,38] in literature. In our study there was no case of hematoma under the flap. Dead space can develop between the graft bed and the myofascia, leading to development of hematoma that blocks blood flow to the grafted flap.[8] An uninterrupted suture over the residual resected muscles of the major pectoral has avoided the formation of hematoma in the donor site.[38,49] Meticulous care in suturing a tension free flap can avoid hematoma formation. Two vacuum drain were kept as routine in the resected and reconstructed site.

G. Montemari, A. Rocco reported that pectoralis major myofascial flap has tolerated the Postoperative radiotherapy well.[37] Revascularized flaps

helped ameliorate the effects of radiation in surgery undergone patients.[18] Robert .E. Marx reported no radiation related complications.[48] In our study among 10 patients, who underwent radiotherapy 1 patient (10%) had complete necrosis of flap, 11.8% had fistula, 10% had implant infection and 30% had reconstruction plate exposure. (Table-21).

The complication could be due to early radiotherapy and excessive fibrosis. The protocol of following radiation therapy after 6-8 weeks could be advisable, to avoid post radiation complications.

Radical surgical procedure should be carried out with caution in old patients with pre-exsisting disease as the chances of life threatening complication are very high in these patients.[8] This makes an indication for the pectoralis major myocutaneous flap to be used in medically compromised patients who are known to have increased complication rates.[8,26] The systemic diseases have to be treated pre and postoperatively with care.[33] Systemic diseases like hypertension, ischemic heart disease, insulin dependent diabetes, cirrhosis were common among the patients who undergo surgery and have very advanced squamous cell carcinomas (T3-T4) in which reconstruction with pectoralis major myocutaneous flap were performed.[47]

In our study out of 17 patients in whom resection & reconstruction was done 47.1% suffered from various systemic illness like diabetes 29.4%, hypertension 29.4% and ischemic heart disease 17.6% of patients.

In our study out of 5 patients with diabetes, none had seroma, 20% (1/5) patients had wound dehiscence, 20% (1/5) patient had partial necrosis, 10% (1/5) patient had implant infection & there was no case of reconstruction plate exposure or total flap necrosis. There was no significant association between diabetes with donor & recipient site complication (Table-23).

Out of 5 patients with hypertension, 10% (1/5) patients had seroma, 10% (1/5) patient had fistula, none had implant infection, 10% (1/5) patient had reconstruction plate exposure, 10% (1/5) patient had complete necrosis. There was no significant association of hypertension with donor and recipient site complication (Table-23).

Out of 3 patients with Ischemic heart disease, none had seroma and partial flap necrosis, and 33% (1/3) had complete necrosis, 33% (1/3) had fistula, 33% (1/3) had implant infection, 33.3% (1/3) had reconstruction plate exposure. There was a significant association between ischemic heart disease and complete necrosis with Chi square value being 4.958 (Table-23).

In our study there was no significant association of donor & recipient site complication in patients with systemic disease like diabetes and hypertension and who have undergone radiotherapy. Higher complication rates were associated with the utilization of the flap as a salvage procedure. Women who underwent Pectoralis Major Myocutaneous Flap had a higher rate of flap necrosis than did men presumably because of interposition of breast tissue between muscle & skin paddle.[2] There were no significant differences

between free flap and Pectoralis Major Myocutaneous Flap groups in age, surgical site infection rate, partial flap necrosis rate, tumor stage, positive surgical margin rate.[12,28] The bulk of the Pectoralis Major Myocutaneous flap is sufficient to allow reasonable function in the context of limited life expectancy. Long-term survivors may be offered a delayed free flap bone reconstruction.[18,32]

Bridging plates represents a useful reconstruction method when the tumor size, age and prognosis did not allow usage of free flaps.[34] The reconstruction plate is used to reconstruct, lateral and small defects but are not effective in bridging large defects. When reconstruction plates were placed across 2 areas with muscle stress concentration (chin and angle of mandible) failure rate was as higher as 68%. Early radiation therapy may have some influence on loss of the reconstruction plate, because it can compromise the healing process of the pectoralis major flap. Bridging plates alone is associated with considerable morbidity, including fracture and loosening of fixation, and most importantly plate exposure. Plate exposure rates can be markedly reduced by covering the plate with a myocutaneous flap.[22, 34, 35]

Fábio Roberto Pinto et al (2010) found that titanium plate exposure in 17.7% cases.[22] In our study 50% (1/2) of cases in floor of the mouth, 33.3% (2/6) cases in alveolus, 18.2% (2/11) patients in stage III, 16.7% (1/6) patients in stage IV, 2 out of 5 patients in T3, 1 out of 4 patients in T4, 12.5% (1/8) with systemic disease, 22.2% (2/7) patients without systemic disease, 30% (3/7)

patients who underwent radiotherapy had reconstruction plate exposure. In literature 18.8% of cases Patients in whom the plate had to be removed have been submitted to radiation therapy in the first 2 postoperative months, and 6 had been submitted to radiation therapy after the second postoperative month.[22,35] In our study we found no significant association between radiotherapy, systemic disease, T-size and reconstruction plate exposure (Table 21, graph 3). In the cases which had gone for radiation had invariably plate related complications. The possible explanation could be of early radiation, the muscle raping around the plate which could have pulled the plate in vertical direction, causing loosening of screws.

The ideal time to start postoperative radiotherapy is within 6 to 8 weeks postoperatively. Titanium is a more suitable material when a radiation therapy is required.[34] From the acceptable success rate, it may be concluded that bridging plates represent a useful reconstruction method, provided they are well covered by viable muscular tissue. They should be offered to patients contraindicated for more invasive procedures or with limited functional needs, or poor prognosis.[25]

Mohamed A Zohairy (2009) in his study reported that fourteen patients died from their disease at the end of 2 years follow-up due to systemic metastases or local recurrence.[35]

The mortality rate within 30 days was high as 7%. In 1-year, 3-years and 5-years, overall survival rates were 65.5%, 39.1% and 11.0%

respectively.[15, 36] The bulk of the Pectoralis myocutaneous flap is sufficient to allow reasonable function in the context of limited life expectancy.[44] In our study 15% (3/20) died due to unknown cause within three months after surgery (Table-19). The functional and social outcome to pectoralis major flap was good and provided a reasonable alternative for reconstruction in advanced disease.

SUMMARY AND CONCLUSION

Pectoralis major myocutaneous pedicled flap has been considered suitable choice for patients in whom reconstructing large defects resulting from excision of head and neck malignancies associated with poor general conditions and radiotherapy. This flap possesses a large volume of vascularized muscle and skin paddle of sufficient size to satisfy the soft tissue reconstructive needs.

Various modalities like free flap, faciomyocutaneous and skin islands of different muscles have been tried, but single stage reconstruction with myocutaneous flap like pectoralis major flap has proved to be advantage in using at, the any form above. The free flap from pectoralis major sounds interesting and has to be tried in larger number to known the possible alternative in soft tissue reconstruction.

In our study, the technique used for Pectoralis major flap elevation was the popular Ariyan technique, by sacrificing the lateral thoracic artery with using of electrocautery for dissection. It proved to have much lesser complication (5.8%) related to flap. The complication rate increased only when the mandible has to be reconstructed with reconstruction plate (29.4%).

Pectoralis major flap vascular pedicle i.e. pectoral branch of thoracoacromial artery is easily identifiable and possibly an early marking with ultrasonography can reduce the flap rising time. The lateral thoracic

artery can be preserved whenever possible. The Pectoralis major flap provides adequate coverage for the vital structures of neck and lies at a less distance from the resected site when the patient has to undergo post operative radiation.

The flap provides large area for defect coverage, and can be used as both mucosal lining and coverage of skin or combination of both. The bulk of Pectoralis major provides good cosmetic benefit after composite resection.

The selection of pectoralis major flap over free flap was influenced by patient factors in most cases. A correctly prepared Pectoralis major myocutaneous flap is nothing inferior to the free flaps. It serves as an alternate flap in head and neck reconstruction when free tissue transfer fails.

The following variables which were related to a higher rate of complications are male sex, age over than 50 years, immediate radiation therapy, presence of co morbidities (hypertension and diabetes), larger flaps, advanced stages (T3 or T4) and the site of reconstruction being the tongue, floor of the mouth, or the oropharynx.

In salvage surgeries, Pectoralis major myocutaneous flap could be the choice comparing to its complications. For the best results, the size and shape of the flap, careful surgical technique avoiding damage to the vascular pedicle and to the musculocutaneous perforating vessels, tension free closure, delayed post radiation (after 6-8 weeks) can be followed.

To conclude our study the Pectoralis major myocutaneous flap remains a valuable reconstructive option in the head and neck owing to its technical ease, reliability and versatility, function, esthetics, reduced postoperative complications in donor and recipient site.

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